Filed: April 12, 2022

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UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.

Petitioner,

v.

MASIMO CORPORATION,

Patent Owner.

Case IPR2020-01536
U.S. Patent 10,588,553

PATENT OWNER'S NOTICE OF APPEAL TO THE U.S. COURT OF APPEALS FOR THE FEDERAL CIRCUIT

Pursuant to 28 U.S.C. § 1295(a)(4)(A), 35 U.S.C. §§ 141(c), 142, and 319, 37 C.F.R. §§ 90.2(a) and 90.3, and Rule 4(a) of the Federal Rules of Appellate Procedure, Patent Owner Masimo Corporation ("Masimo") hereby appeals to the United States Court of Appeals for the Federal Circuit from the Judgement – Final Written Decision (Paper No. 43) entered on February 23, 2022 (Attachment A) and from all underlying orders, decisions, rulings, and opinions that are adverse to Masimo related thereto and included therein, including those within the Decision Granting Institution of *Inter Partes* Review, entered March 2, 2021 (Paper 9). Masimo appeals the Patent Trial and Appeal Board's determination that claims 1–29 of U.S. Patent 10,588,553 are unpatentable, and all other findings and determinations, including but not limited to claim construction, as well as all other issues decided adverse to Masimo's position or as to which Masimo is dissatisfied in IPR2020-01536 involving U.S. Patent 10,588,553.

Masimo is concurrently providing true and correct copies of this Notice of Appeal, along with the required fees, with the Director of the United States Patent and Trademark Office and the Clerk of the United States Court of Appeals for the Federal Circuit.

Respectfully submitted,

KNOBBE, MARTENS, OLSON & BEAR, LLP

Dated: April 12, 2022

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Masimo Corporation

ATTACHMENT A

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571-272-7822

Paper 43
Date: February 23, 2022

UNITED STATES PATENT AND TRADEMARK OFFICE

BEFORE THE PATENT TRIAL AND APPEAL BOARD

APPLE INC.,
Petitioner,

v.

MASIMO CORPORATION,
Patent Owner.

IPR2020-01536
Patent 10,588,553 B2

Before GEORGE R. HOSKINS, ROBERT L. KINDER, and AMANDA F. WIEKER, *Administrative Patent Judges.*

KINDER, *Administrative Patent Judge*.

JUDGMENT
Final Written Decision
Determining All Challenged Claims Unpatentable
35 U.S.C. § 318(a)

I. INTRODUCTION

A. Background

Apple Inc. ("Petitioner") filed a Petition requesting an *inter partes* review of claims 1–29 ("challenged claims") of U.S. Patent No. 10,588,553 B2 (Ex. 1001, "the '553 patent"). Paper 3 ("Pet."). Masimo Corporation ("Patent Owner") waived filing a Preliminary Response. Paper 8.

On March 2, 2021, we instituted trial. Paper 9 ("Inst. Dec." or "Decision to Institute"). Patent Owner filed a Response. Paper 24 ("PO Resp."). Petitioner filed a Reply. Paper 27 ("Pet. Reply"). Patent Owner filed a Sur-reply. Paper 32 ("Sur-reply"). An oral argument was held on December 7, 2021, and a transcript was entered into the record. Paper 42 ("Tr.").

We have jurisdiction to conduct this *inter partes* review under 35 U.S.C. § 6. This Final Written Decision is issued pursuant to 35 U.S.C. § 318(a) and 37 C.F.R. § 42.73. For the reasons discussed herein, we determine that Petitioner has shown, by a preponderance of the evidence, that all challenged claims (claims 1–29) of the '553 patent are unpatentable.

B. Related Matters

The parties identify the following matters related to the '553 patent:

Masimo Corporation v. Apple Inc., Civil Action No. 8:20-cv-00048 (C.D. Cal.) (filed Jan. 9, 2020);

Apple Inc. v. Masimo Corporation, IPR2020-01537 (PTAB Aug. 31, 2020) (also challenging claims 1–29 of the '553 patent);

Apple Inc. v. Masimo Corporation, IPR2020-01520 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,258,265 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01521 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,292,628 B1);

Apple Inc. v. Masimo Corporation, IPR2020-01523 (PTAB Sept. 9, 2020) (challenging claims of U.S. Patent No. 8,457,703 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01524 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 10,433,776 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01526 (PTAB Aug. 31, 2020) (challenging claims of U.S. Patent No. 6,771,994 B2);

Apple Inc. v. Masimo Corporation, IPR2020-01538 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2); and

Apple Inc. v. Masimo Corporation, IPR2020-01539 (PTAB Sept. 2, 2020) (challenging claims of U.S. Patent No. 10,588,554 B2).

Pet. 3–4; Paper 5, 3.

Patent Owner further identifies certain pending patent applications, as well as other issued and abandoned applications, that claim priority to, or share a priority claim with, the ’553 patent. Paper 5, 1–2.

C. The ’553 Patent

The ’553 patent is titled “Multi-Stream Data Collection System for Noninvasive Measurement of Blood Constituents,” and issued on March 17, 2020, from U.S. Patent Application No. 16/534,949, filed August 7, 2019. Ex. 1001, codes (21), (22), (45), (54). The ’553 patent claims priority through a series of continuation and continuation-in-part applications to Provisional Application Nos. 61/078,228 and 61/078,207, both filed July 3, 2008. *Id.* at codes (60), (63).

The ’553 patent relates to noninvasive methods and devices for measuring various blood constituents or analytes. *Id*. at code (57). The ’553

patent discloses a two-part data collection system including a noninvasive sensor that communicates with a patient monitor. *Id.* at 2:38–40. The sensor includes a sensor housing, an optical source, and several photodetectors, and is used to measure a blood constituent or analyte, e.g., oxygen or glucose. *Id.* at 2:29–35, 64–65. The patient monitor includes a display and a network interface for communicating with a handheld computing device. *Id.* at 2:45–48.

Figure 1 of the '553 patent is reproduced below.

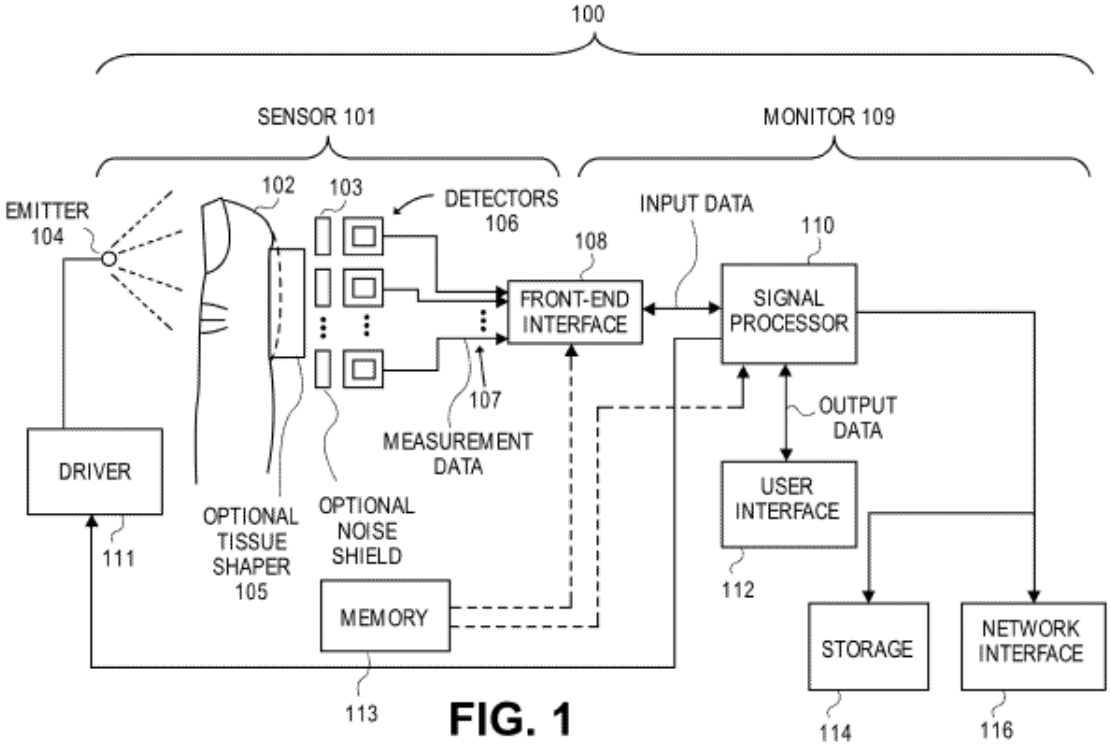


FIG. 1

Figure 1 illustrates a block diagram of data collection system 100 including sensor 101 and monitor 109. *Id.* at 11:47–58. Sensor 101 includes optical emitter 104 and detectors 106. *Id.* at 11:59–63. Emitters 104 emit light that is attenuated or reflected by the patient's tissue at measurement site 102. *Id.* at 14:3–7. Detectors 106 capture and measure the light attenuated or reflected from the tissue. *Id.* In response to the measured light,

detectors 106 output detector signals 107 to monitor 109 through front-end interface 108 and detectors 106 can be implemented using photodiodes. *Id.* at 14:7–10, 26–32. Sensor 101 also may include tissue shaper 105, which may be in the form of a convex surface that: (1) reduces the thickness of the patient's measurement site; and (2) provides more surface area from which light can be detected. *Id.* at 11:2–14.

Monitor 109 includes signal processor 110 and user interface 112. *Id.* at 15:16–18. "[S]ignal processor 110 includes processing logic that determines measurements for desired analytes . . . based on the signals received from the detectors." *Id.* at 15:21–24. User interface 112 presents the measurements to a user on a display, e.g., a touch-screen display. *Id.* at 15:46–56. The monitor may be connected to storage device 114 and network interface 116. *Id.* at 15:60–16:11.

The '553 patent describes various examples of sensor devices. Figures 14D and 14F, reproduced below, illustrate sensor devices.

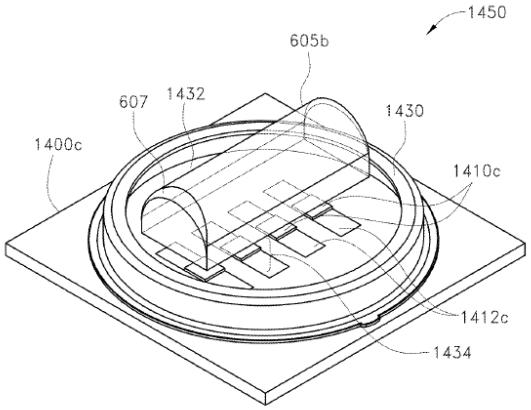


FIG. 14D

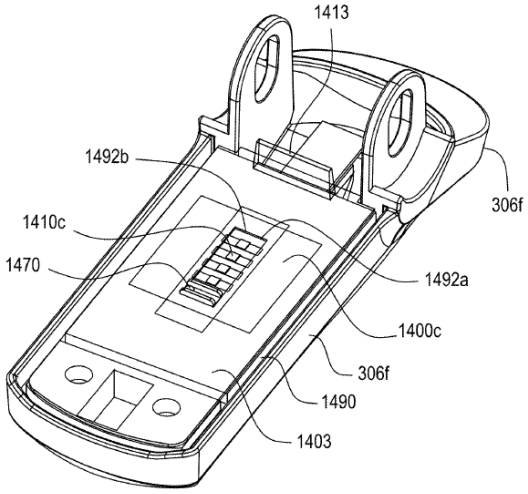


FIG. 14F

Figure 14D (left) illustrates portions of a detector submount and Figure 14F (right) illustrates portions of a detector shell. *Id.* at 6:44–47. As shown in

Figure 14D, multiple detectors 1410c are located within housing 1430 and under transparent cover 1432, on which protrusion 605b (or partially cylindrical protrusion 605) is disposed. *Id.* at 35:36–39, 36:30–37. Figure 14F illustrates a detector shell 306f including detectors 1410c on substrate 1400c. *Id.* at 37:9–25. Substrate 1400c is enclosed by shielding enclosure 1490 and noise shield 1403, which include window 1492a and window 1492b, respectively, placed above detectors 1410c. *Id.* Alternatively, cylindrical housing 1430 may be disposed under noise shield 1403 and may enclose detectors 1410c. *Id.* at 37:47–48.

Figures 4A and 4B, reproduced below, illustrate an alternative example of a tissue contact area of a sensor device.

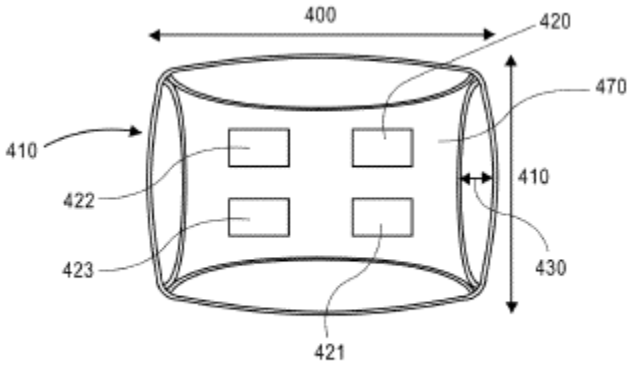


FIG. 4A

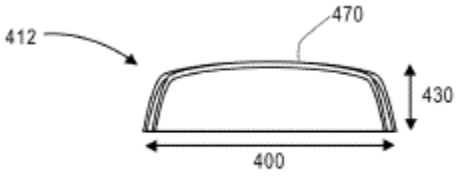


FIG. 4B

Figures 4A and 4B illustrate arrangements of protrusion 405 including measurement contact area 470. *Id.* at 23:18–24. "[M]easurement site contact area 470 can include a surface that molds body tissue of a measurement site." *Id.* "For example, . . . measurement site contact area 470 can be generally curved and/or convex with respect to the measurement site." *Id.* at 23:39–43. The measurement site contact area may include windows 420–423 that "mimic or approximately mimic a configuration of, or even house, a plurality of detectors." *Id.* at 23:49–63.

D. Illustrative Claim

Of the challenged claims, claims 1, 10, and 20 are independent. Claim 1 is illustrative and is reproduced below.

> 1. A noninvasive optical physiological sensor comprising:
>
> [a] a plurality of emitters configured to emit light into tissue of a user;
>
> [b] at least four detectors, wherein at least one of the at least four detectors is configured to detect light that has been attenuated by tissue of the user, and wherein the at least four detectors are arranged on a substrate;
>
> [c] a wall configured to circumscribe at least the at least four detectors; and
>
> [d] a cover configured to be located between tissue of the user and the at least four detectors when the noninvasive optical physiological sensor is worn by the user, wherein the cover comprises a single protruding convex surface operable to conform tissue of the user to at least a portion of the single protruding convex surface when the noninvasive optical physiological sensor is worn by the user, and wherein the wall operably connects to the substrate and the cover.

Ex. 1001, 44:50–67 (bracketed identifiers a–d added). Independent claims 10 and 20 include limitations substantially similar to limitations [a]–[d] of claim 1. *Id.* at 45:35–47, 46:22–46.

E. Applied References

Petitioner relies upon the following references:

> Mendelson, U.S. Patent No. 6,801,799 B2, filed February 6, 2003, issued October 5, 2004 (Ex. 1012, "Mendelson-799");
>
> Ohsaki et al., U.S. Patent Application Publication No. 2001/0056243 A1, filed May 11, 2001, published December 27, 2001 (Ex. 1009, "Ohsaki");

Schulz et al., U.S. Patent Application Publication No. 2004/0054291 A1, filed July 31, 2003, published March 18, 2004 (Ex. 1013, "Schulz");

Griffin et al., U.S. Patent No. 7,658,613 B1, filed January 16, 2007, issued February 9, 2010 (Ex. 1014, "Griffin"); and

Y. Mendelson et al., "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," Proceedings of the 28th IEEE EMBS Annual International Conference, 912–915 (2006) (Ex. 1010, "Mendelson-2006").

Pet. 9.

Petitioner also submits, *inter alia*, the Declaration of Thomas W. Kenny, Ph.D. (Ex. 1003), as well as a Second Declaration of Dr. Kenny (Ex. 1047). Patent Owner relies, *inter alia*, on the Declaration of Vijay K. Madisetti, Ph.D. (Ex. 2004). The parties rely on numerous other exhibits and cross examination testimony as discussed below.

F. Asserted Grounds

Petitioner asserts that claims 1–29 are unpatentable based upon the following grounds:

Claim(s) Challenged	35 U.S.C. §	References/Basis
1–3, 5, 6, 9–18, 20–24, 29	103	Mendelson-799, Ohsaki
4, 18, 24	103	Mendelson-799, Ohsaki, Schulz
25	103	Mendelson-799, Ohsaki, Griffin
7, 19	103	Mendelson-799, Ohsaki, Mendelson-2006
8, 26–28	103	Mendelson-799, Ohsaki, Mendelson-2006, Griffin

II. DISCUSSION

A. Claim Construction

For petitions filed on or after November 13, 2018, a claim shall be construed using the same claim construction standard that would be used to construe the claim in a civil action under 35 U.S.C. § 282(b). 37 C.F.R. § 42.100(b) (2019). Petitioner submits that no claim term requires express construction. Pet. 7–8. Patent Owner submits that claim terms should be given their ordinary and customary meaning, consistent with the Specification. PO Resp. 7.

Based on our analysis of the issues in dispute, we agree that no claim terms require express construction. *Nidec Motor Corp. v. Zhongshan Broad Ocean Motor Co.*, 868 F.3d 1013, 1017 (Fed. Cir. 2017).

B. Principles of Law

A claim is unpatentable under 35 U.S.C. § 103 if "the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains." *KSR Int'l Co. v. Teleflex Inc.*, 550 U.S. 398, 406 (2007). The question of obviousness is resolved on the basis of underlying factual determinations, including (1) the scope and content of the prior art; (2) any differences between the claimed subject matter and the prior art; (3) the level of skill in the art; and (4) objective evidence of non-obviousness.[1] *Graham v. John Deere Co.*, 383 U.S. 1, 17–18 (1966). When

[1] Based on the final record, neither party introduced objective evidence of non-obviousness.

evaluating a combination of teachings, we must also "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR*, 550 U.S. at 418 (citing *In re Kahn*, 441 F.3d 977, 988 (Fed. Cir. 2006)). Whether a combination of prior art elements would have produced a predictable result weighs in the ultimate determination of obviousness. *Id.* at 416–417.

In an *inter partes* review, the petitioner must show with particularity why each challenged claim is unpatentable. *Harmonic Inc. v. Avid Tech., Inc.*, 815 F.3d 1356, 1363 (Fed. Cir. 2016); 37 C.F.R. § 42.104(b). The burden of persuasion never shifts to Patent Owner. *Dynamic Drinkware, LLC v. Nat'l Graphics, Inc.*, 800 F.3d 1375, 1378 (Fed. Cir. 2015).

We analyze the challenges presented in the Petition in accordance with the above-stated principles.

C. Level of Ordinary Skill in the Art

Petitioner identifies the appropriate level of skill in the art as that possessed by a person "hav[ing] a Bachelor of Science degree in an academic discipline emphasizing the design of electrical, computer, or software technologies, in combination with training or at least one to two years of related work experience with capture and processing of data or information." Pet. 7 (citing Ex. 1003 ¶¶ 1–18, 20–21). "Alternatively, the person could have also had a Master of Science degree in a relevant academic discipline with less than a year of related work experience in the same discipline." *Id.*

Patent Owner makes several observations regarding Petitioner's identified level of skill in the art but, "[f]or this proceeding, [Patent Owner] nonetheless applies Petitioner's asserted level of skill." PO Resp. 8.

We adopt Petitioner's assessment as set forth above, which is consistent with the level of skill reflected in the Specification and prior art.

D. Obviousness over the Combined Teachings of Mendelson-799 and Ohsaki

Petitioner contends that claims 1–3, 5, 6, 9–18, 20–24, and 29 of the '553 patent would have been obvious over the combined teachings of Mendelson-799 and Ohsaki. Pet. 10–62. Patent Owner disagrees and presents several arguments, including that the combination of Ohsaki and Mendelson-799 discloses "two different physiological monitor designs, with distinct shapes, features, and detector and emitter configurations." PO Resp. 9, 9–42; *see also generally* Sur-reply.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of the evidence that claims 1–3, 5, 6, 9–18, 20–24, and 29 are unpatentable.

1. Overview of Mendelson-799 (Ex. 1012)

Mendelson-799 is titled "Pulse Oximeter and Method of Operation," and discloses a sensor for non-invasive measurement of a blood parameter, which includes a sensor housing, a radiation source, and a detector. Ex. 1012, codes (54), (57).

Figure 7 of Mendelson-799 is reproduced below.

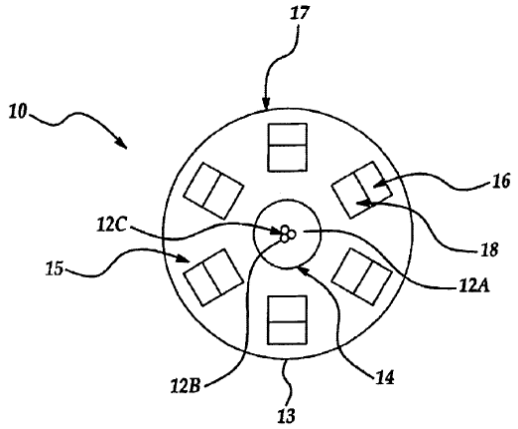


Figure 7

Figure 7 illustrates optical sensor 10 with light source 12, which includes three closely spaced light emitting elements 12a, 12b, 12c. *Id.* at 9:22–28. Optical sensor 10 includes an array of discrete detectors, i.e., "far" detectors 16 and "near" detectors 18, "arranged in two concentric ring-like arrangements . . . surrounding the light emitting elements." *Id.* at 9:29–34. "[L]ight shield 14 is positioned between the photodiodes and the light emitting elements, and prevents direct optical coupling between them, thereby maximizing the fraction of backscattered light passing through the arterially perfused vascular tissue in the detected light." *Id.* at 9:35–40. Sensor housing 17 accommodates the light source, light shield, and detectors. *Id.* at 9:34–35.

Figure 8 of Mendelson-799 is reproduced below.

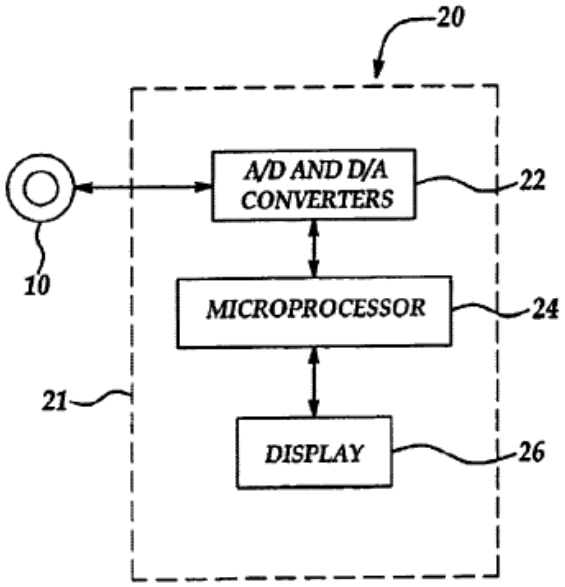


Figure 8

Figure 8 illustrates a block diagram of pulse oximeter 20 using sensor 10. *Id.* at 10:16–17. Pulse oximeter 20 includes control unit 21, with electronic block 22 connectable to sensor 10, microprocessor 24, and display 26, which presents measurement results. *Id.* at 10:17–22. "The measured data (i.e., electrical output of the sensor 10 indicative of the detected light) is directly processed in the block 22, and the converted signal is further processed by the microprocessor 24." *Id.* at 10:22–25.

2. Overview of Ohsaki (Ex. 1009)

Ohsaki is titled "Wristwatch-type Human Pulse Wave Sensor Attached on Back Side of User's Wrist," and discloses an optical sensor for detecting a pulse wave of a human body. Ex. 1009, code (54), ¶ 3.

Figure 1 of Ohsaki is reproduced below.

FIG. 1

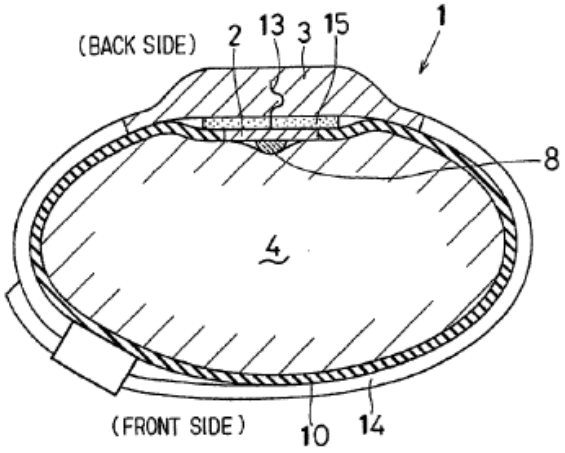


Figure 1 illustrates a cross-sectional view of pulse wave sensor 1 attached on the back side of user's wrist 4. *Id.* ¶¶ 12, 16. Pulse wave sensor 1 includes detecting element 2 and sensor body 3. *Id.* ¶ 16.

Figure 2 of Ohsaki, reproduced below, illustrates further detail of detecting element 2.

FIG. 2

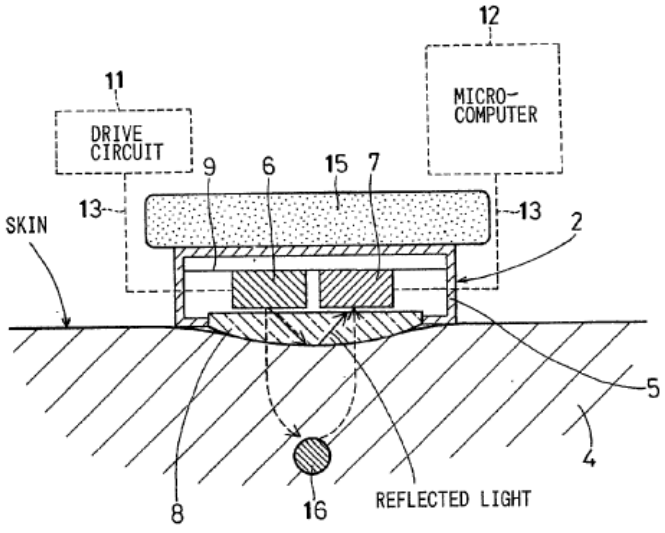


Figure 2 illustrates a mechanism for detecting a pulse wave. *Id.* ¶ 13. Detecting element 2 includes package 5, light emitting element 6, light

receiving element 7, and translucent board 8. *Id.* ¶ 17. Light emitting element 6 and light receiving element 7 are arranged on circuit board 9 inside package 5. *Id.* ¶¶ 17, 19.

"[T]ranslucent board 8 is a glass board which is transparent to light, and attached to the opening of the package 5. A convex surface is formed on the top of the translucent board 8." *Id.* ¶ 17. "[T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin," preventing detecting element 2 from slipping off the detecting position of the user's wrist. *Id.* ¶ 25. By preventing the detecting element from moving, the convex surface suppresses "variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin." *Id.* Additionally, the convex surface prevents penetration by "noise such as disturbance light from the outside." *Id.*

Sensor body 3 is connected to detecting element 2 by signal line 13. *Id.* ¶ 20. Signal line 13 connects detecting element 2 to drive circuit 11, microcomputer 12, and a monitor display (not shown). *Id.* Drive circuit 11 drives light emitting element 6 to emit light toward wrist 4. *Id.* Detecting element 2 receives reflected light which is used by microcomputer 12 to calculate pulse rate. *Id.* "The monitor display shows the calculated pulse rate." *Id.*

3. Independent Claim 1

Petitioner contends that claim 1 would have been obvious over the combined teachings of Mendelson-799 and Ohsaki. Pet. 10–42. Patent Owner presents several arguments, as examined below, as to why all claims in this ground would not have been obvious. *See* PO Resp. 9–43. Below,

we set forth how the limitations not disputed by Patent Owner are taught by the combination of references as argued by Petitioner. For those limitations and reasons for combining the references that are disputed, we first examine each of the parties' contentions and then provide our analysis.

i. "A noninvasive optical physiological sensor comprising"

Based on the final record, the cited evidence supports Petitioner's undisputed contention that the combination of Mendelson-799 and Ohsaki satisfies the subject matter of the preamble.[2] Pet. 30–31; *see, e.g.*, Ex. 1012, code (57) ("A sensor for use in an optical measurement device and a method for non-invasive measurement of a blood parameter."), 4:13–22, 7:25–8:41, 9:22–10:30, Fig. 7 (sensor device), Fig. 8; Ex. 1009, code (57), ¶¶ 3, 8, 15–17, 20, 25, Figs. 1, 2, 4A, 4B; Ex. 1003 ¶¶ 55–69, 78–98, 99–103.

ii. "[a] a plurality of emitters configured to emit light into tissue of a user"

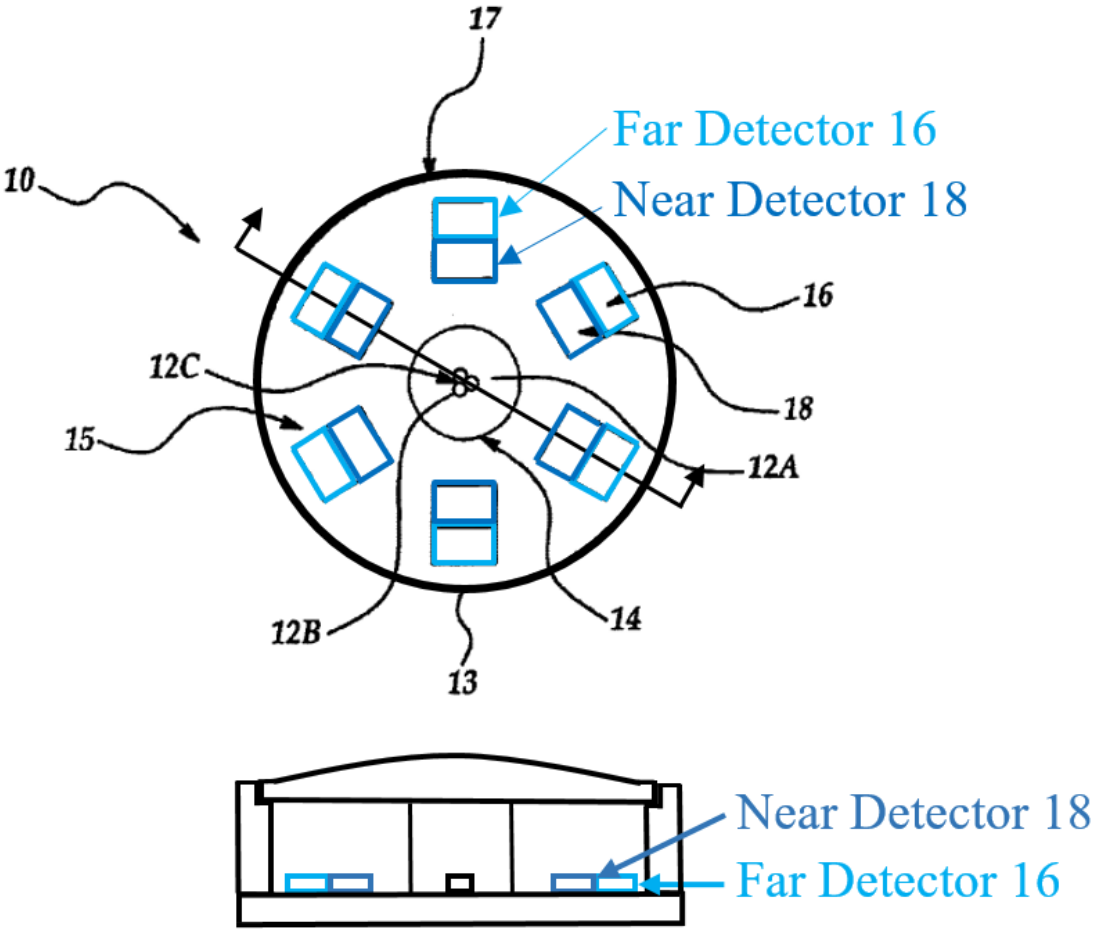
The cited evidence supports Petitioner's undisputed contention that Mendelson-799 discloses light emitting elements 12a, 12b, and 12c that emit light into a user's tissue. Pet. 31–33; *see, e.g.*, Ex. 1012, 9:22–40 ("The sensor 10 comprises . . . light source 12 composed of three closely spaced light emitting elements (e.g., LEDs or laser sources) 12a, 12b and 12c generating light of three different wavelengths."), Fig. 7 (LEDs or laser sources 12a, 12b and 12c); *see also id.* at 9:42–10:15 (noting that "[t]he actual numbers of wavelengths used as a light source and the number of

[2] Whether the preamble is limiting need not be resolved, because Petitioner shows persuasively on the final record that the recitation in the preamble is satisfied by the prior art.

photodetectors in each ring are not limited and depend only on the electronic circuitry inside the oximeter"). Further, Dr. Kenny persuasively testifies that "[f]rom this and related description, one of ordinary skill would have understood that Mendelson '799 discloses a plurality of emitters configured to emit light into tissue of a user." Ex. 1003 ¶ 106; *see also id.* ¶¶ 55–69, 78–98, 104–107.

iii. "[b] at least four detectors, wherein at least one of the at least four detectors is configured to detect light that has been attenuated by tissue of the user, and wherein the at least four detectors are arranged on a substrate;"

Based on the final record, the cited evidence supports Petitioner's undisputed contentions regarding this limitation. Pet. 33–36. Specifically, Petitioner contends that Mendelson-799 discloses twelve photodetectors located within a sensor housing. Pet. 33; *see, e.g.*, Ex. 1012, 9:22–48 ("The sensor 10 comprises . . . an array of discrete detectors (e.g., photodiodes)."), Fig. 7 (depicting rings of six far detectors 16 and six near detectors 18). Petitioner further contends that "each of the twelve discrete photodiodes included in the detector assembly illustrated in Mendelson '799's FIG. 7 (reproduced below) are 'adapted to detect reflected radiation . . . and to generate respective signals' that 'are used to determine the parameter of the blood.'" Pet. 33 (quoting Ex. 1012, code (57), 9:22–48). Petitioner provides an annotated and modified view of Mendelson-799's Figure 7, as well as an added sectional view, both of which are reproduced below. Pet. 34; *see also id.* at 38 (similar figures with slightly different annotations).



Petitioner's modified and added figures depict the sensor of Mendelson-799 with "Far Detector 16" (illustrated in light blue) and "Near Detector 18" (illustrated in dark blue).[3] *Id.* at 34.

Petitioner next relies on Figure 3 of Mendelson-799, reproduced below, which depicts traditional reflection-mode or backscatter type pulse oximetry sensors.

[3] Petitioner's annotated figures also include an added opaque wall and an added top cover as discussed *infra*.

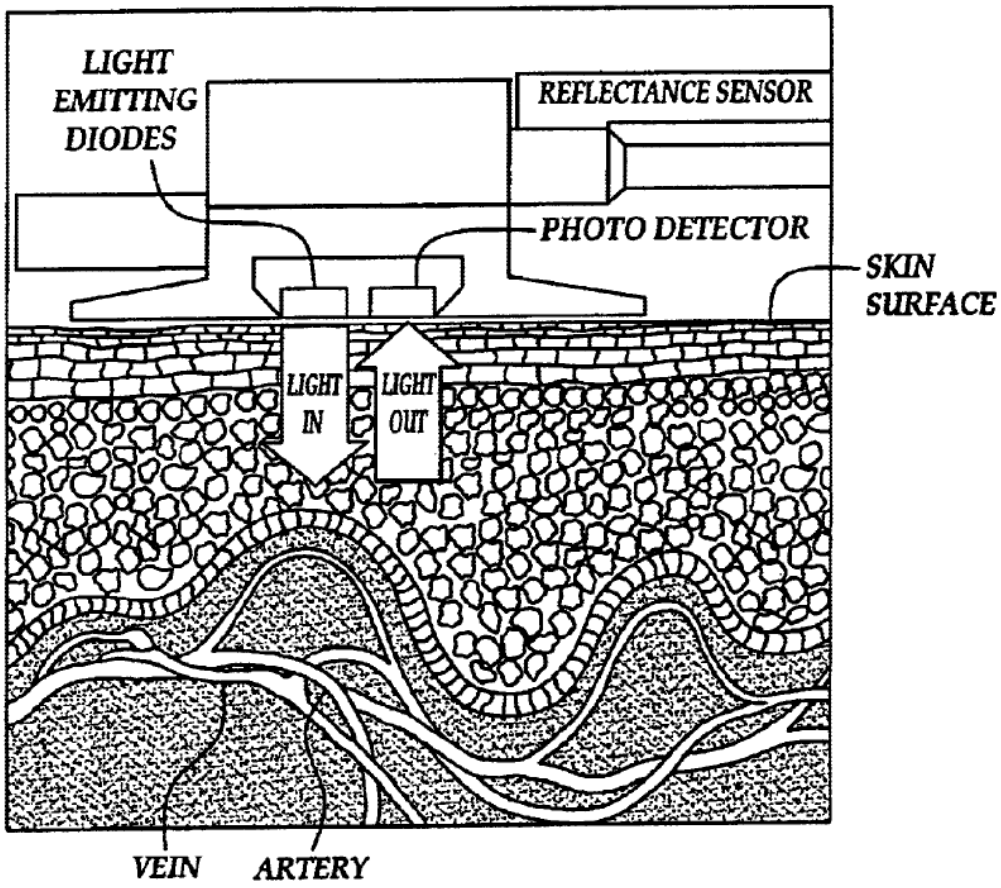


Figure 3 of Mendelson-799 depicts the relative disposition of light source and detector in reflection-mode or backscatter type pulse oximetry. Ex. 1012, 8:26–28. According to Petitioner, the sensor shown in Figure 3 features LEDs and a photodetector that are mounted side-by-side next to each other on the same planar substrate, which allows for measuring SaO_2 from multiple convenient locations on the body. Pet. 34–35 (citing Ex. 1012 2:14–28, Fig. 3; Ex. 1003 ¶¶ 110–111 ("[A]lthough the sensor depicted in Mendelson '799's FIG. 7 features two concentric rings of discrete photodetectors that are arranged in a radially-symmetric manner about central light emitting elements, the photodetectors and the light emitting elements are arranged on the same planar substrate.").

We find Petitioner's contentions for these limitations are persuasive, including by the testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 108–113.

> *iv. "[c] a wall configured to circumscribe at least the at least four detectors; and"*
>
> *"[d] a cover configured to be located between tissue of the user and the at least four detectors when the noninvasive optical physiological sensor is worn by the user, wherein the cover comprises a single protruding convex surface operable to conform tissue of the user to at least a portion of the single protruding convex surface when the noninvasive optical physiological sensor is worn by the user, and wherein the wall operably connects to the substrate and the cover."*

Petitioner's Undisputed Contentions

Petitioner explains that Mendelson-799 does not disclose a cover located between the user's tissue and the at least four detectors, as claimed. Pet. 21–22. Patent Owner does not dispute this contention, and we agree that Mendelson-799 is not shown to include a cover. *See generally* Ex. 1012.

Petitioner contends that although Mendelson-799 does not disclose a cover as claimed, Ohsaki teaches a wrist-worn sensor "that includes a light permeable convex cover—'translucent board 8'— . . . where the cover comprises a single protruding convex surface operable to conform [to] tissue of the user." Pet. 22; *see, e.g.*, Ex. 1009 ¶¶ 16 ("worn on the back side of the user's wrist"), 17 ("convex surface"), Figs. 1–2 (depicting translucent board 8 between tissue and detector); Ex. 1003 ¶ 83. Petitioner also contends that Ohsaki's Figure 2 depicts the user's tissue conforming to the shape of the

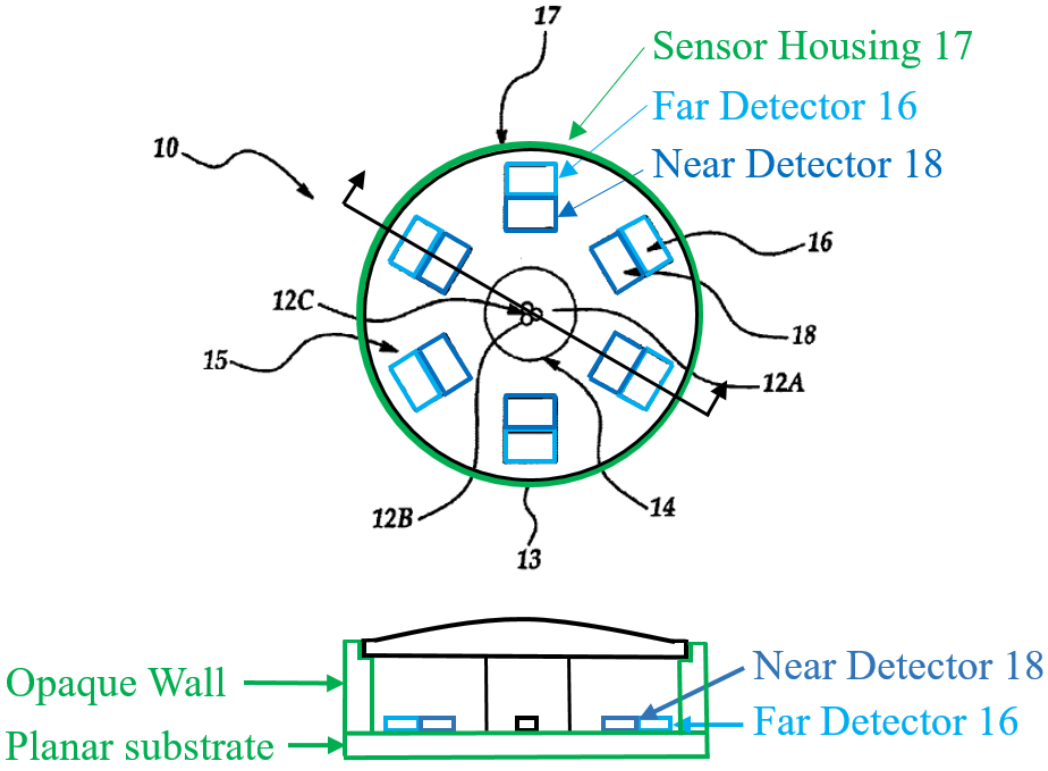
convex surface of the cover. Pet. 23–26, 39–41; *see, e.g.*, Ex. 1003 ¶¶ 55–69, 78–98, 127–136.

Patent Owner does not dispute this contention, and we agree with Petitioner. Ohsaki discloses that sensor 1 is "worn on the back side of the user's wrist" and includes translucent board 8, with a single convex surface formed on the top of the board, to be placed against a user's tissue. Ex. 1009 ¶¶ 16, 17, Figs. 1–2 (depicting translucent board 8 between tissue and detector). As shown in Ohsaki's Figure 2, the convex surface of board 8 is operably connected to the walls of sensor package 5 that houses the sensor components, including circuit board 9, light emitting element 6 (e.g., LED), and light receiving element 7. *Id.* ¶ 17 ("The translucent board 8 is . . . attached to the opening of the package 5."), Fig. 2. As depicted in Ohsaki's Figure 2, the user's tissue 4 is shown to conform to the shape of the protruding convex surface when the sensor is worn by the user. Ex. 1009 ¶ 17 ("The translucent board 8 is a glass board."), Fig. 2.

Petitioner's Disputed Contentions

Petitioner contends that Mendelson-799 discloses sensor housing 17 that encircles detectors 16 and 18. Pet. 36–37; *see, e.g.*, Ex. 1012, 9:23–40 ("All these elements are accommodated in a sensor housing 17."), Fig. 7 (housing 17). Petitioner further contends that a person of ordinary skill in the art would have found it obvious "to connect, to the illustrated portion of sensor housing 17, an opaque wall configured to circumscribe the array of discrete detectors included in detector rings 16 and 18" to shield the detectors from ambient light and to protect from external forces. Pet. 37–38; *see, e.g.*, Ex. 1003 ¶¶ 55–69, 78–98, 114–126.

As shown below, Petitioner alleges that it would have been obvious to connect, to the illustrated portion of sensor housing 17, an opaque wall configured to circumscribe the array of discrete detectors included in detector rings 16 and 18. Pet. 37–38. Petitioner relies on Ohsaki's disclosure of a sensor including package 5 having a wall that surrounds light emitting element 6 and light receiving element 7. *Id.*; *see, e.g.*, Ex. 1009 ¶ 17, Fig. 2 (detector 7 surrounded by wall of package 5); Ex. 1003 ¶¶ 115–125.



Above, Petitioner depicts Mendelson-799's Figure 7 and its modified sectional view with several annotations and modifications. Pet. 38; Ex. 1019, Fig. 7. Petitioner's modified and added figures depict the sensor of Mendelson-799 with an added opaque wall (illustrated in green) connected to the planar substrate (also illustrated in green) of housing 17 and

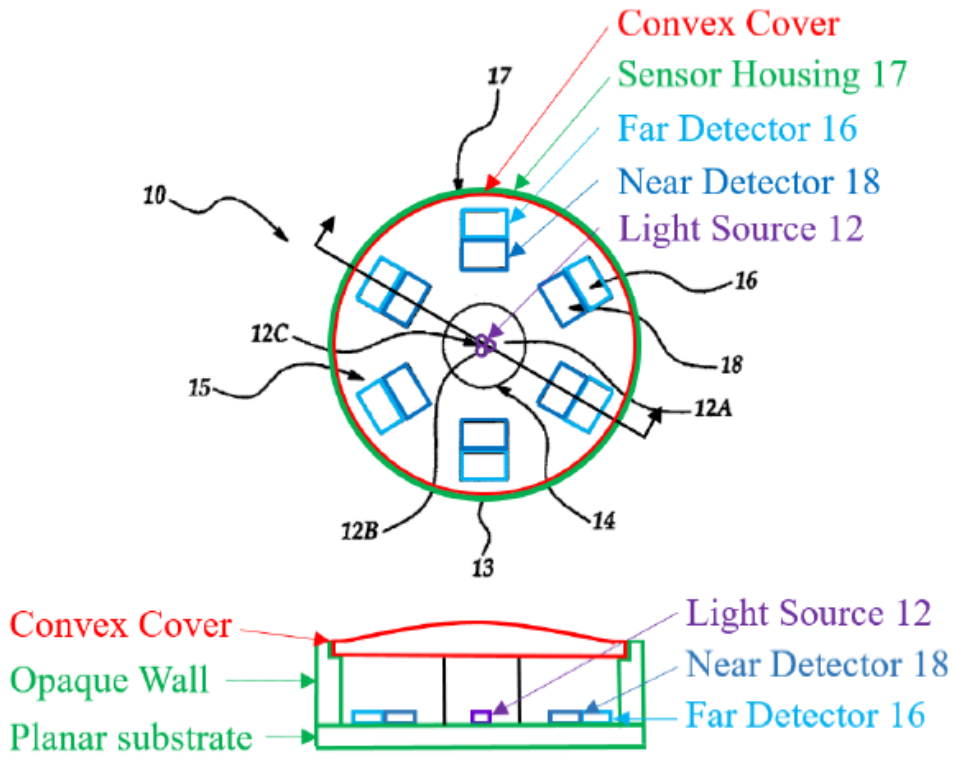
encircling the sensor components, as Petitioner contends would have been obvious to a person of ordinary skill in the art. Pet. 37–39, 26.

Petitioner further contends that a person of ordinary skill in the art "would have recognized that a light permeable cover with a protruding convex surface," such as that taught by Ohsaki, "would improve adhesion between the sensor and the user's tissue, improve detection efficiency, and protect the elements within sensor housing 17." Pet. 21–22 (citing, e.g., Ex. 1003 ¶ 81; Ex. 1009 ¶¶ 15, 17, 25), 29–30. Petitioner contends that Ohsaki's convex surface is in intimate contact with the user's tissue, which prevents slippage of the sensor and increases signal strength because "variation of the amount of the reflected light . . . that reaches the light receiving element 7 is suppressed" and "disturbance light from the outside" is prevented from penetrating board 8, as compared to a sensor with a flat surface. *Id.* at 23–24 (quoting Ex. 1009 ¶ 25). Dr. Kenny likewise testifies that a person of ordinary skill in the art "would have recognized that a light permeable cover with a protruding convex surface would improve adhesion between the sensor and the user's tissue, improve detection efficiency, and protect the elements within sensor housing 17." Ex. 1003 ¶ 81 (citing Ex. 1009 ¶¶ 15, 17, 25, Figs. 1, 2, 4A, 4B); Pet. 21–22.

Accordingly, Petitioner contends that, to achieve these benefits, a person of ordinary skill in the art "would have added a transparent convex cover to [Mendelson-799's] sensor 10, the cover being located between tissue of the user and the array of detectors 16 and 18 when worn," and would have "configured Mendelson-799's circumscribing wall to operably connect" to the convex and rigid cover. Pet. 25–26, 40–41; *see, e.g.*, Ex. 1003 ¶¶ 55–69, 78–98, 127–136.

Petitioner contends these modifications would have been "nothing more than the use of a known technique to improve similar devices in the same way, and combining prior art elements according to known methods to yield predictable results—improved adhesion of the sensor to the user's skin, and improved signal strength," where "the elements of the resulting sensor would each perform functions they had been known to perform prior to the combination." Pet. 29 (citing, e.g., Ex. 1003 ¶¶ 91–98).

To illustrate its proposed modification, the Petition includes an annotated and modified view of Mendelson-799's Figure 7, as well as an added sectional view, both of which are reproduced below. Pet. 30; *see also id.* at 41 (same).

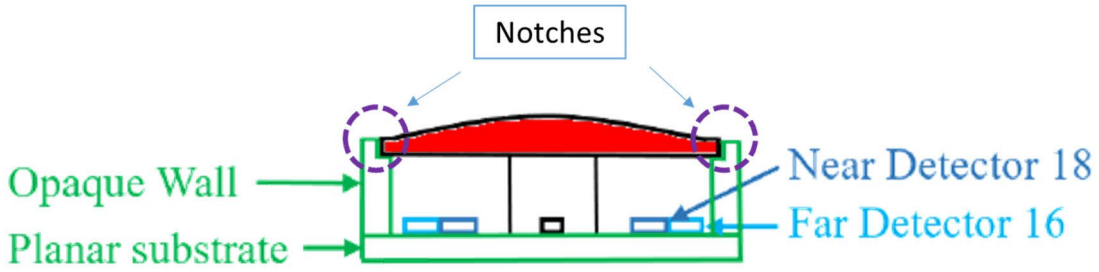


Petitioner's modified and added figures depict the sensor of Mendelson-799 with an added convex cover (illustrated in red) connected to the opaque wall

(illustrated in green) that Petitioner contends would have been obvious to a person of ordinary skill in the art. Pet. 41.

Patent Owner's Contentions

Patent Owner contends that the proposed combination adds features not found in the cited references, with no motivation or explanations for why a person of ordinary skill in the art would have added these features. PO Resp. 12. Patent Owner contends that the depiction of a cover spanning the entire space above the substrate lacks support. Patent Owner notes that Ohsaki places its translucent board in an opening within the top of the package. *Id.* at 13 (citing Ex. 1009, Fig. 2). Patent Owner further contends that the proposed combination includes a wall with notches for the cover, as depicted below in Patent Owner's annotated figure, yet neither Mendelson-799 nor Ohsaki include a notched wall feature. *Id.* (citing Ex. 2004 ¶¶ 46–47; Ex. 2008, 205:21–208:19). Patent Owner provides an annotated figure, reproduced below.



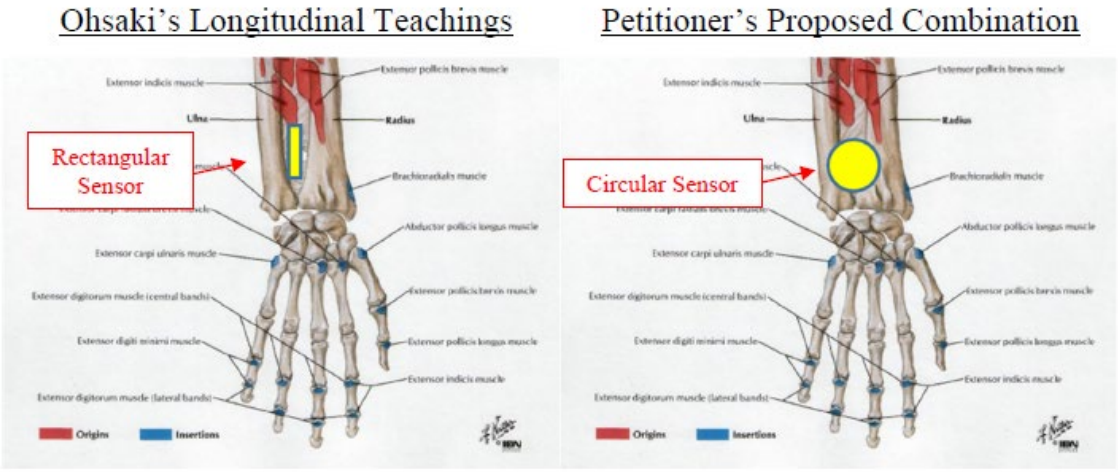
Patent Owner's annotated figure adds purple circles around "Notches" to Petitioner's already annotated figure depicting the proposed combination of a cover, as suggested by Ohsaki, with Mendelson-799's sensor. PO Resp. 13 (original figure at Pet. 38). Patent Owner alleges that the addition of a notch is significant and would impact performance because "the notch insets the cover into the wall, which changes the cover's height relative to

the underlying optical components," and "[t]he notch also uses a light shield shorter than the surrounding wall." *Id.* at 13–14 (Ex. 2004 ¶¶ 46–47).

Patent Owner makes several arguments as to how modifying Ohsaki's rectangular board would eliminate the advantages Ohsaki teaches. PO Resp. 17. First, Patent Owner argues that the proposed modification "changes Ohsaki's structure and eliminates the longitudinal shape that gives Ohsaki's translucent board the ability to fit within the user's anatomy and prevent slipping." *Id.* This argument is premised on Patent Owner's contention that Ohsaki's convex cover must be rectangular, with the cover's long direction aligned with the length of the user's forearm, to avoid interacting with bones in the wrist and forearm. *Id.* at 17–19 (citing, e.g., Ex. 2004 ¶¶ 51–54; Ex. 1009 ¶¶ 6, 19, 23, 24); *see also* Sur-reply 3–8. According to Patent Owner, Ohsaki teaches that "aligning the sensor's longitudinal direction with the ***circumferential*** direction of the user's arm undesirably results in 'a tendency [for Ohsaki's sensor] to slip off.'" *Id.* at 19–20 (citing Ex. 1009 ¶ 19), 20–22; *see also* Sur-reply 4 ("Petitioner never explained how or why a POSITA would change Ohsaki's ***longitudinal*** board into a ***circular*** cover. That change would eliminate the longitudinal shape that Ohsaki indicates prevents slipping.").

Thus, Patent Owner contends that Petitioner's proposed modification would "chang[e] Ohsaki's rectangular board into a ***circular*** shape," which "would eliminate the advantages discussed above" because it "cannot be placed in ***any longitudinal*** direction and thus cannot coincide with the longitudinal direction of the user's wrist." PO Resp. 20 (citing Ex. 2004 ¶¶ 50–57). Patent Owner presents annotated Figures depicting what it

contends is Ohsaki's disclosed sensor placement as compared to that of the proposed modification, reproduced below.

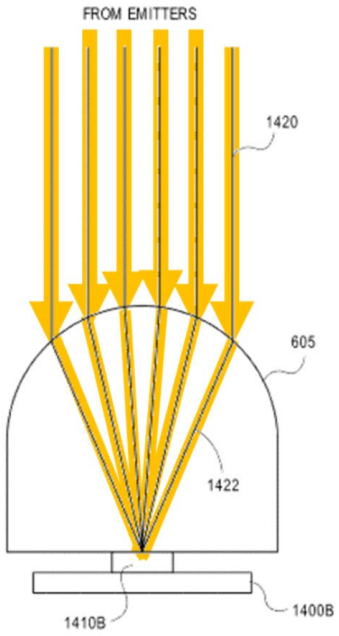


Patent Owner's annotated Figure on the left depicts a rectangular sensor placed between a user's radius and ulna, while Patent Owner's annotated Figure on the right depicts a circular sensor placed across a user's radius and ulna. PO Resp. 21. Based on these annotations, Patent Owner argues that the proposed "circular shape would press on the user's arm in all directions and thus cannot avoid the undesirable interaction with the user's bone structure," such that a skilled artisan "would have understood such a change would eliminate Ohsaki's benefit of preventing slipping." *Id.* at 21–22 (citing, e.g., Ex. 2004 ¶¶ 54–57). Similarly, Patent Owner contends that "adding Ohsaki's ***rectangular*** board to Mendelson '799's oxygen saturation sensor would eliminate the ***radially*** symmetric environment and undermine the reason for Mendelson '799's use of multiple detectors arrayed in a ring pattern." *Id.* at 25 (citing Ex. 1012, 7:25–37).

Second, Patent Owner argues that Ohsaki requires its sensor be placed on the back of the user's wrist to achieve any benefits, but that such a location would have been unsuitable for Mendelson-799's sensor, and would

result in weak sensor signals. PO Resp. 26. Relying on other publications by the named inventor on Mendelon-799, Patent Owner alleges that sensor signals were difficult or impossible to discern from the wrist, even with considerable pressure. *Id.* (citing Ex. 2003, 3–4); *see also id.* at 26–27 (citing Ex. 2015, 3, 4; Ex. 2014, 1, 99; Ex. 2004 ¶ 65). Patent Owner contends that Dr. Kenny admitted during cross examination that signals from the wrist are weaker and noisier than signals from other locations. *Id.* at 27 (citing Ex. 2008, 249:10–16, 255:12–21); *see also id.* at 27–30 (citing Ex. 2017, 2; Ex. 2018, 4 ("reflected red and infrared pulses can only be used for specific areas, such as a radial artery; thus, most areas of the wrist are not available for monitoring"); Ex. 2010, 44, 71; Ex. 2016, 2, 3).

Third, Patent Owner argues that a person of ordinary skill in the art would not have placed Ohsaki's convex cover over Mendelson-799's peripheral detectors because the convex cover would condense light toward the center and away from the detectors, which would decrease signal strength. PO Resp. 31–34 (citing, e.g., Ex. 2004 ¶¶ 71–75). Patent Owner relies on Figure 14B of the '553 patent, which Patent Owner contends supports its position. *Id.* at 32–33 (citing Ex. 1001, 36:3–6, 36:13–15).



Patent Owner's annotated Figure 14B of the '553 patent adds highlighting to show direction of the light. PO Resp. 33. According to Patent Owner, the convex shape directs light from the periphery toward the center. *Id.* at 32; *see also* Sur-reply 16 ("Petitioner and Dr. Kenny both admitted a convex cover condenses light towards the sensor's center and away from the sensor's periphery.").

Patent Owner also contends that Dr. Kenny admits as much, fails to account for the impact of the proposed modification on light collection, and fails to propose a specific three-dimensional structure to embody the proposed modification. PO Resp. 32–37 (citing, e.g., Ex. 2004, 71–72; Ex. 2006, 204:14–20; Ex. 2008, 36:19–37:1, 57:19–58:16, 63:5–64:8, 170:12–171:1, 173:8–15). Patent Owner argues that "[d]espite testifying that all the design details would be critical in assessing the impact on optics, neither Petitioner nor Dr. Kenny provide ***any analysis*** of the impact of Petitioner's modifications on light collection by the detectors," and "Petitioner's failure to address optics is particularly glaring because the

invention is a noninvasive ***optical*** physiological sensor (claim 1) or measuring device (claim 20)." PO Resp. 35.

Fourth, Patent Owner argues that Ohsaki's rectangular cover creates air gaps at its peripheral edges, as shown in Ohsaki's Figure 1, which Mendelson-799 cautions against as potentially causing "specular reflection." PO Resp. 36–37 (citing, e.g., Ex. 1012, 2:58–64; Ex. 2004 ¶ 76). Patent Owner, relying on the testimony of Dr. Madisetti, contends that a person of ordinary skill in the art "would have understood that air gaps near the detectors on the peripheral edge of Mendelson '799's more complicated oximeter sensor would create significant noise." *Id.* at 38 (citing Ex. 2004 ¶ 79 ("peripheral air gaps would be positioned near or over Mendelson '799's peripheral detectors leading to inconsistent measurements")). Accordingly, Patent Owner argues that a person of ordinary skill in the art would not have modified Mendelson-799's structure to add Ohsaki's air gaps. *Id.* at 37–38 (citing Ex. 2004 ¶¶ 77–79).

Fifth, Patent Owner argues that "a convex cover is just one of many different alternatives for protecting the components of a sensor" including, e.g., resin or encapsulation. PO Resp. 38–40. Concerning possible alternatives, Patent Owner contends that a person of ordinary skill in the art "would have understood that a flat cover would provide ***better protection*** than a convex surface because, as Petitioner's cited art teaches, it would be less prone to scratches." *Id.* at 39–40 (citing Ex. 1008 ¶ 106).

Patent Owner further argues that "Petitioner fails to provide evidence that its combination, with its many flaws, would reasonably be expected to successfully result in an effective noninvasive optical physiological sensor or measurement device." PO Resp. 40. Patent Owner relies on testimony

that the design analysis required to create a functional optical physiological sensor would be complex and involve trial and error. *Id.* Yet, even with such a design, "Dr. Kenny admitted he did ***no*** analysis to see what impact his proposed changes would have on the operability of his proposed combination, nor could he explain what effect any changes to the sensors would ultimately have on the operability of his proposed combination." *Id.*

Petitioner's Reply

In its Reply, Petitioner reiterates that "Ohsaki would have motivated one of ordinary skill to add a light permeable protruding convex cover to Mendelson '799's sensor, to [1] improve adhesion between the sensor and the user's tissue, to [2] improve detection efficiency, and to [3] provide additional protection to the elements accommodated within sensor housing 17." Pet. Reply 1 (quoting Ex. 1003 ¶ 87). Examining Patent Owner's arguments related to shape, structure, and location of sensors, Petitioner notes that Ohsaki does not limit its benefits to a rectangular pulse rate sensor applied to a particular body location. *Id.* at 2. Instead, Petitioner argues that Ohsaki attributes the reduction of slippage afforded by use of a translucent board, and related improvements in signal quality, to the convex surface of the translucent board being in intimate contact with the surface of a user's skin. *Id.* (citing Ex. 1003 ¶ 84; Ex. 1009 ¶¶ 15, 17–18, 25, Figs. 1, 2, 4A, 4B).

Concerning Patent Owner's first and second arguments (longitudinal shape and sensor placed on the back of the user's wrist), Petitioner responds that Ohsaki does not disclose the shape of its protrusion, other than its convexity as shown in Figures 1 and 2, nor does Ohsaki require a rectangular shape or placement on the back of the wrist in order to achieve

the disclosed benefits. Pet. Reply 6–12 (citing, e.g., Ex. 1047 ¶¶ 21–30). Moreover, Petitioner asserts that "even if Ohsaki's translucent board 8 were somehow understood to be rectangular, obviousness does not require 'bodily incorporation' of features from one reference into another"; rather, a person of ordinary skill in the art "would have been fully capable of attaching a light permeable protruding convex cover to Me[nd]elson-799's housing to obtain the benefits attributed to such a cover by Ohsaki." *Id.* at 10 (citing, e.g., Ex. 1047 ¶ 26). Similarly, regarding the location of the sensor, Petitioner asserts,

> [E]ven if a [person of ordinary skill in the art] would have somehow misunderstood Ohsaki's sensor as limited to placement on the backside of the wrist, and even if the difficulty that [Patent Owner] alleges with respect to obtaining pulse oximetry measurements from that location were true, that ***would have further motivated*** the [person of ordinary skill in the art] to implement a light permeable convex cover in Mendelson-799's sensor, to improve detection efficiency.

Id. at 11 (citing, e.g., Ex. 1047 ¶ 28).

Concerning Patent Owner's third argument, Petitioner responds that adding a convex cover to Mendelson-799's sensor would not decrease signal strength but, instead, "would improve Mendelson-799's signal-to-noise ratio by causing more light backscattered from tissue to strike Mendelson-799's detectors than would have absent the cover" because such a cover improves light concentration across the entire lens and does not direct it only towards the center. *Id.* at 13–17 (citing, e.g., Ex. 1047 ¶¶ 31–47).

Petitioner dismisses Patent Owner's reliance on Figure 14B of the '553 patent because it "is not an accurate representation of light that has been reflected from a tissue measurement site. For example, the light rays (1420) shown in FIG. 14B are collimated (i.e., travelling paths parallel to

one another), and each light ray's path is perpendicular to the detecting surface." Pet. Reply 14–15 (citing, e.g., Ex. 1047 ¶¶ 32–34). Moreover, Petitioner argues that, even when collimated, light will focus at the center only if the light beam happens to be perfectly aligned with the axis of symmetry of the lens and, when entering at any other angle, will focus at a different point. *Id.* at 15 (citing, e.g., Ex. 1047 ¶ 34).

According to Petitioner, Patent Owner's and Dr. Madisetti's position regarding convergence toward the center does not apply to diffuse light, which reaches the detectors from various random angles and directions after having been reflected by tissue. *Id.* at 15–16 (citing, e.g., Ex. 1047 ¶¶ 36–37). As a result, Petitioner contends Ohsaki's cover would have provided a refracting effect such that light rays that would have missed the detectors absent a cover are instead directed to that area as they pass through the cover. *Id.* at 16–17 (citing Ex. 1047 ¶¶ 37–39). Dr. Kenny testifies how the light that backscatters from the measurement site after diffusing through tissue reaches the circular active detection area of Mendelson-799's detectors and further applies principles of Snell's law to explain the effects of the convex board on the propagation of light rays from a diffuse source. Ex. 1047 ¶ 37, 39–43. Petitioner thus contends that "overall, more of the partially reflected, transmitted, absorbed, and ultimately back scattered light strikes the detectors than otherwise would have absent the cover." Pet. Reply 17–18 (citing Ex. 1047 ¶¶ 45–47).

Concerning Patent Owner's fourth argument, Petitioner responds that a skilled artisan would have known to avoid air gaps in the proposed combination. *Id.* at 18 (citing, e.g., Ex. 1047 ¶¶ 48–49). Further, Petitioner

contends that "some minor air gaps" would not obviate the motivation to combine even if they remained. *Id.* at 19.

Concerning Patent Owner's fifth argument, Petitioner responds that even if a flat surface might be less prone to scratching, that possible disadvantage would have been weighed against the "multiple advantages of a convex cover," and would not negate a motivation to combine. *Id.* at 19–20 (citing, e.g., Ex. 1047 ¶ 52).

Patent Owner's Sur-reply

Concerning Patent Owner's first and second arguments, Patent Owner reiterates its position that Ohsaki's purported benefits attach only to a sensor with a rectangular convex surface that is located on the back of the wrist, and that "even small changes in sensor orientation or measurement location result in slippage." Sur-reply 3–14, 8.

Concerning Patent Owner's third argument, Patent Owner argues that Dr. Kenny and Petitioner have not overcome their admissions that a convex lens directs light toward the center. *Id.* at 15–16 (citing, e.g., Ex. 2004 ¶¶ 71–72).

Patent Owner also asserts that Petitioner mischaracterizes Patent Owner's position, which is not that a convex cover focuses "***all*** light" to a single point at the center of the sensor. *Id.* at 17. Patent Owner instead states that, "[l]ight entering the convex surface from ***all*** angles would, on ***average***, result in ***more light directed towards the center*** and ***less light at the periphery***—as compared to a flat surface—and therefore less light at the peripherally located detectors." *Id.* (citing Ex. 2004 ¶¶ 70–75).

Finally, Patent Owner argues that Petitioner's Reply arguments are overly complex and instead a person of ordinary skill in the art "would have

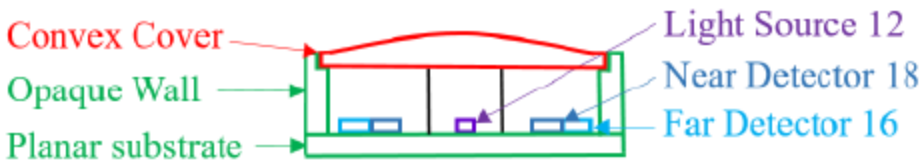
understood and applied the straightforward understanding that a convex surface condenses light toward the center." *Id.* at 19–20.

Concerning Patent Owner's fourth argument, Patent Owner argues that "Petitioner does not dispute that . . . air gaps would dissuade a [person of ordinary skill in the art] from modifying Mendelson[-]799." *Id.* at 20–21.

Concerning Patent Owner's fifth argument, Patent Owner argues that Petitioner does not dispute Patent Owner's position that a flat cover would be less prone to scratches and offers "***no*** plausible advantages for its asserted combination." *Id.* at 22–23. Moreover, Patent Owner argues that "the risk of scratches is not merely a disadvantage—it directly undermines Petitioner's motivation to add a convex cover to provide 'additional ***protection***.'" *Id.* at 23.

Analysis

We have considered the parties' arguments and cited evidence, and we are persuaded by Petitioner's contentions. As shown in Petitioner's modified figures below, the wall of the combined sensor surrounds the sensor components and is operably connected to the convex cover on the top and is operably connected to the planar substrate on the bottom, as claimed.



Petitioner's annotated Figure 7 from Mendelson-799 shows the proposed combination with a convex cover (red), and opaque wall and planar substrate (green). Pet. Reply 5; *see also* Ex. 1003 ¶ 88 ("[O]ne of ordinary skill would have configured Mendelson 799's circumscribing wall to operably

connect, on one side, to the planar substrate on which detectors 16 and 18 are arranged and, on an opposite side, to the convex cover."). We credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated to configure the wall, substrate and convex cover such that the circumscribing wall operably connects, on one side, to the planar substrate on which detectors 16 and 18 are arranged and, on an opposite side, to the convex cover. *See id.*

Moreover, as discussed more below, Petitioner's proposed modifications to Mendelson-799 are *not* premised upon bodily incorporating Ohsaki's cover directly with Mendelson-799's sensor. *See In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) ("Combining the teachings of references does not involve an ability to combine their specific structures."). To the contrary, Petitioner proposes incorporating Ohsaki's *teaching* of a cover with a convex surface, not the precise cover and structure disclosed by Ohsaki. *In re Keller*, 642 F.2d 413, 425 (CCPA 1981) ("[T]he test is what the combined teachings of those references would have suggested to those of ordinary skill in the art."). If Ohsaki's teaching is implemented in a manner that varies from the precise implementation of such a cover in Ohsaki, e.g., with a larger span or with notches, this is not a material deviation from Ohsaki's express teachings of using a cover with a convex surface to achieve specific benefits, e.g., improved adhesion and signal strength. Ex. 1009 ¶ 25; *see supra* § II.D.5.vi; *see Lear Siegler, Inc. v. Aeroquip Corp*., 733 F.2d 881, 889 (Fed. Cir. 1984) (explaining that a person of ordinary skill is not "compelled to adopt every single aspect of [a reference] without the exercise of independent judgment"). As explained by Dr. Kenny, a person of ordinary skill in the art "would have found it obvious to add notches to

improve the reliability of the connection between the convex cover and housing." Ex. 1047 ¶ 55 (citing Ex. 2008, 208:1–5, 206:20–207:4). Based on the final record, Petitioner's stated reasoning for the proposed modifications are sufficiently supported, including by the testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 55–69, 78–98, 127–136.

As noted above, Petitioner provides three rationales to support its contention that a person of ordinary skill in the art would have provided "a light permeable cover with a protruding convex surface," such as that taught by Ohsaki, to Mendelson-799's sensor: (1) to "improve adhesion between the sensor and the user's tissue," (2) to "improve detection efficiency," and (3) to "protect the elements within sensor housing 17." Pet. 25 (citing, e.g., Ex. 1003 ¶ 87; Ex. 1009 ¶¶ 15, 17, 25). As further examined below, we determine all three rationales are supported by the evidence, and further that any single rationale standing alone would have been sufficient to establish a basis for the person of ordinary skill in the art to combine the references as proposed.

Rationales 1 and 2

The evidence of record persuades us that adding a convex cover, such as that taught by Ohsaki, would have improved adhesion between the sensor and the user's skin, which would have increased the signal strength of the sensor. Ohsaki teaches as much:

> [T]he convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin. Thereby *it is prevented that the detecting element 2 slips off* the detecting position of the user's wrist 4. If the translucent board 8 has a flat surface, the detected pulse wave is adversely affected by the movement of the user's wrist 4 as shown in Fig. 4B. However, in the case that the translucent board 8 has a convex surface like the present embodiment, the *variation of the amount of the*

> *reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed. It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8.* Therefore the pulse wave can be detected without being affected by the movement of the user's wrist 4 as shown in FIG. 4A.

Ex. 1009 ¶ 25 (emphases added); *see also id.* ¶ 27 ("stably fixed").

We credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated by such teachings to apply a cover with a convex surface to Mendelson-799 to improve that similar device in the same way and to yield predictable results, i.e., to resist movement of the sensor on the user's wrist. *See, e.g.*, Ex. 1003 ¶ 84 ("[T]his contact between the convex surface and the user's skin is said to prevent slippage, which increases the strength of the signals obtainable by Ohsaki's sensor."). We also credit Dr. Kenny's testimony that, in light of these teachings, a person of ordinary skill in the art would have made such a modification to improve the pulse sensor's ability to emit light into, and detect light reflected from, the user's wrist, to generate an improved pulse signal. Ex. 1003 ¶¶ 83–87; Ex. 1047 ¶ 17.

Indeed, Ohsaki expressly compares the performance of a wrist-worn pulse wave sensor depending on whether translucent board 8 is convex or flat, and concludes the convex surface results in improved performance over the flat surface, especially when the user is moving. Ex. 1009, Figs. 4A–4B, ¶¶ 15, 25 (stating that with "a flat surface, the detected pulse wave is adversely affected by the movement of the user's wrist 4," and with "a convex surface like the present embodiment, the variation of the amount of the reflected light" collected by the sensor "is suppressed"). Ohsaki also

states that, with a convex surface, "[i]t is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8." *Id.* ¶ 25.

We also credit Dr. Kenny's testimony that the proposed modification would have been within the level of ordinary skill in the art. For example, Dr. Kenny testifies:

> The above-described modification would require only routine knowledge of sensor design and assembly. . . . Indeed, the modification would have amounted to nothing more than the use of a known technique to improve similar devices in the same way, and combining prior art elements according to known methods to yield predictable results—improved adhesion of the sensor to the user's skin, and improved signal strength.
>
> Furthermore, the elements of the resulting sensor would each perform functions they had been known to perform prior to the combination—Ohsaki's translucent board 8 would simply be placed over the components accommodated within Mendelson '799's sensor housing 17, and would perform the same function as taught by Ohsaki.

Ex. 1003 ¶¶ 97–98; *see also id.* ¶¶ 88–90. In light of Ohsaki's express disclosure of the benefits of a convex cover, we credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated to modify Mendelson-799 as proposed, and would have had a reasonable expectation of success in doing so.

We next address Patent Owner's first through fourth arguments, each of which implicates Petitioner's first and second asserted rationales of improved adhesion and detection efficiency.

Patent Owner's first argument is premised on the notion that Ohsaki's benefits only can be realized with a rectangular convex surface, because such a shape is required to avoid interacting with bones on the back of the

user's forearm. PO Resp. 17–25. We disagree. Ohsaki does not disclose the shape of its convex cover, much less require it be rectangular. In fact, Ohsaki is silent as to the shape of the convex surface. Ohsaki discloses that sensor 1 includes detecting element 2, which includes package 5 within which the sensor components are located. Ex. 1009 ¶ 17. Ohsaki's convex surface is located on board 8, which is "attached to the opening of the package 5." *Id.* Ohsaki provides no further discussion regarding the shape of board 8 or its convex surface.

We disagree with Patent Owner's suggestion that the shape of the convex surface can be inferred to be rectangular from Ohsaki's Figures 1 and 2. PO Resp. 17–21. Ohsaki does not indicate that these figures are drawn to scale, or reflect precise dimensions or shapes of the convex surface. *See, e.g.*, Ex. 1009 ¶ 13 ("schematic diagram"); *see also* Pet. Reply 9; *Hockerson-Halberstadt, Inc. v. Avia Group Int'l*, 222 F.3d 951, 956 (Fed. Cir. 2000) ("[I]t is well established that patent drawings do not define the precise proportions of the elements and may not be relied on to show particular sizes if the specification is completely silent on the issue.").

To be clear, Ohsaki describes the shape of *detecting element 2* as rectangular: "[T]he length of the detecting element 6 from the right side to the left side in FIG. 2 is longer than the length from the upper side to the lower side." Ex. 1009 ¶ 19. Ohsaki also describes that detecting element 2 is aligned longitudinally with the user's forearm: "[I]t is desirable that the detecting element 2 is arranged so that its longitudinal direction agrees with the longitudinal direction of the user's arm," to avoid slipping off. *Id.*; *see also id.* ¶ 9 ("The light emitting element and the light receiving element are arranged in the longitudinal direction of the user's arm.").

In light of this disclosed rectangular shape of detecting element 2, it is certainly possible that Ohsaki's convex surface may be similarly shaped. But, it may not be. Contrary to Patent Owner's argument, Ohsaki neither describes nor requires detecting element 2 to have the same shape as the convex surface of board 8. *Accord* Pet. Reply 7–8 (noting also that Ohsaki's board 8 "is not coextensive with the entire tissue-facing side of detecting element 2"). We have considered the cited testimony of both Dr. Kenny and Dr. Madisetti on this point. Ex. 1047 ¶¶ 21–24; Ex. 2004 ¶¶ 38–42 (relying on Ohsaki's Figures 1–2 to support his opinion that the convex surface is rectangular). Dr. Madisetti's reliance on the dimensions of Ohsaki's figures is unpersuasive. *Hockerson-Halberstadt*, 222 F.3d at 956. We credit Dr. Kenny, who testifies that Ohsaki does not describe its convex surface as rectangular, because this testimony is most consistent with Ohsaki's disclosure.

Further, Patent Owner suggests that the convex surface *must be* rectangular, in order to avoid interacting with bones in the user's forearm. Sur-reply 6 ("intended placement take advantage of the forearm/wrist area's particular bone structure to prevent slipping"), 9 ("[A] POSITA would have understood Ohsaki's convex board must also have a longitudinal shape oriented up-and-down the watch-side of the user's wrist/forearm."). Although Ohsaki recognizes that interaction with these bones can cause slippage problems, *see* Ex. 1009 ¶¶ 6, 19, we do not agree that the *only way* to avoid these bones is by aligning a rectangular cover with the longitudinal direction of the user's forearm. For example, in the annotated Figures provided by Patent Owner, *see* PO Resp. 20–21, we discern that the circular sensor that purports to depict the proposed modification would *also* avoid

the bones in the forearm if it were slightly smaller. Patent Owner provides no persuasive explanation to justify the dimensions it provides in this annotated figure, or to demonstrate that such a large circular sensor would have been required. Indeed, we discern that it would have been within the level of skill of an ordinary artisan to appropriately size a modified sensor to avoid these well-known anatomical obstacles. "A person of ordinary skill is also a person of ordinary creativity, not an automaton." *KSR Int'l Co.*, 550 U.S. at 421. After all, an artisan must be presumed to know something about the art apart from what the references disclose. *See In re Jacoby*, 309 F.2d 513, 516 (CCPA 1962).

Finally, we do not agree with Patent Owner's position that Ohsaki's advantages apply only to rectangular convex surfaces. As discussed, Patent Owner has not shown that Ohsaki's convex surface is rectangular at all. Moreover, even if Ohsaki's convex surface is rectangular, when discussing the benefits associated with a convex cover, Ohsaki does not limit those benefits to a cover of any particular shape. Instead, Ohsaki explains that "detecting element 2 is arranged on the user's wrist 4 so that the convex surface of the translucent board 8 is in intimate contact with the surface of the user's skin. Thereby it is prevented that the detecting element 2 slips off the detecting position of the user's wrist 4." Ex. 1009 ¶ 25; Ex. 1047 ¶ 15 ("Ohsaki nowhere describes its benefits as being limited to a rectangular pulse rate sensor applied to a particular body location. . . . Instead . . . Ohsaki attributes the reduction of slippage afforded by use of translucent board 8" to the convex surface being in intimate contact with the skin.). Thus, we agree with Petitioner that Ohsaki's teaching of a convex surface would have motivated a person of ordinary skill in the art to add such a

surface to Mendelson-799's circular-shaped sensor, to improve adhesion as taught by Ohsaki. *See, e.g.*, Pet. 21–25. Nothing in Ohsaki's disclosure limits such a benefit to a specific shape of the convex surface. Ex. 1047 ¶¶ 11–12.

Moreover, Ohsaki contrasts its convex surface with a flat surface and notes that,

> in the case that the translucent board 8 has a convex surface . . . the variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed. It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8. Therefore the pulse wave can be detected without being affected by the movement of the user's wrist 4 as shown in FIG. 4A.

Ex. 1009 ¶ 25; Ex. 1047 ¶ 17. Thus, we agree with Petitioner that Ohsaki's teaching of a convex surface would have motivated a person of ordinary skill in the art to add such a surface to Mendelson-799's sensor, to improve signal strength, as taught by Ohsaki. *See, e.g.*, Pet. 23–27. Again, nothing in Ohsaki's disclosure limits such a benefit to the shape of the convex surface. Ex. 1047 ¶¶ 15–17.

Accordingly, we do not agree that Ohsaki's disclosed advantages attach only to a rectangular convex surface, or would have been inapplicable to the proposed combination of Mendelson-799 and Ohsaki.[4]

[4] Patent Owner also argues that, to the extent contended by Petitioner, it would not have been obvious to place a rectangular cover on top of Mendelson-799's sensor. PO Resp. 29–31. We do not understand Petitioner to have made any such contention and, accordingly, do not address this argument. *See, e.g.*, Pet. 31 (depicting circular convex surface over circular sensor).

We have considered Patent Owner's second argument, that Ohsaki's benefits are realized only when the sensor and convex surface are placed on the back of the user's wrist, which is an unsuitable location for Mendelson-799's sensor. PO Resp. 26–30. We do not agree. As an initial matter, Petitioner does not propose bodily incorporating the references; Petitioner simply proposes adding a convex cover to Mendelson-799's sensor, without discussing where Mendelson-799's sensor is used. *See, e.g.*, Pet. 25–26. In other words, Petitioner's proposed modification does not dictate any particular placement. Moreover, Mendelson-799 states that its sensor "allows for measuring SaO_2 from multiple convenient locations on the body (e.g. the head, torso, or upper limbs)." Ex. 1012, 2:17–19; *see also* Ex. 1019, 104[5] ("The idea of using skin reflectance spectrophotometry marked a significant advancement in the noninvasive monitoring of SaO_2 from virtually any point on the skin surface."). Thus, we do not agree that Mendelson-799 discourages or disparages use on the back of the wrist, or suggests that an unacceptably weak signal would be obtained from another location.

Notwithstanding the foregoing, and assuming for sake of argument that a person of ordinary skill in the art would have expected a weaker signal if Mendelson-799's sensor was used on the back of the wrist, that alone does not nullify the proposed combination. "[A] given course of action often has simultaneous advantages and disadvantages, and this does not necessarily obviate motivation to combine." *Medichem, S.A. v. Rolabo, S.L.*, 437 F.3d 1157, 1165 (Fed. Cir. 2006) (citation omitted). Indeed, we discern that, in such a location that results in decreased signal quality, a person of ordinary

[5] Citation to Petitioner's added page numbering.

skill in the art would have been further motivated to improve signal quality, e.g., by employing Ohsaki's convex surface. *See, e.g.*, Ex. 1047 ¶¶ 27–30; Ex. 1009 ¶ 25 ("[I]n the case that the translucent board 8 has a convex surface like the present embodiment, the variation of the amount of the reflected light which is emitted from the light emitting element 6 and reaches the light receiving element 7 by being reflected by the surface of the user's skin is suppressed. It is also prevented that noise such as disturbance light from the outside penetrates the translucent board 8.").

We have considered Patent Owner's third argument that a convex cover would condense light away from Mendelson-799's peripheral detectors, which Patent Owner alleges would decrease signal strength. PO Resp. 31–36. We disagree. There appears to be no dispute that when emitted light that passes through user tissue, the light is diffused and scattered as it travels. *See, e.g.*, Pet. Reply 13–18; Tr. 27:18–28:3 (Petitioner's counsel agreeing that "the incoming light from a detection standpoint is going to be coming from all sorts of different directions because of the randomness caused by the back scattering"), 65:23–66:13 (Patent Owner's counsel agreeing that light does not simply enter tissue and come back out "like it came out on a mirror"); Ex. 1041, 35:19–37:18 (Patent Owner's declarant describing light scattering as it travels through tissue, e.g., reflecting off blood, tissue, or other material); Ex. 1043, 28:2–10 (Patent Owner's declarant agreeing that reflecting light can be a signal for the '553 patent's sensor), 61:20–62:4 (explaining that "a light in this context, light emitted from the LEDs is diffused through the skin in that particular context, whatever that is."). The light thus travels at random angles and directions, and no longer travels in a collimated and perpendicular manner.

Dr. Kenny testifies that Mendelson-799 and Ohsaki detect light that has been partially reflected, transmitted, absorbed, and scattered by the skin and other tissues and the blood before it reaches the detector. Ex. 1047 ¶ 36. Dr. Kenny further opines that, "the POSITA would have understood that Mendelson-799's sensor, which includes multiple photodiodes placed symmetrically with respect to a central light source, offers the advantage of *enabling a large fraction of light randomly backscattered from tissue to be detected within the circular active detection area surrounding that source*," thus increasing the light-gathering ability of Mendelson-799's sensor. *Id.* ¶ 43 (emphasis added); *see also id.* ¶ 44 ("Ohsaki's cover provides a refracting effect, such that light rays that otherwise would have missed the detection area are instead directed toward that area as they pass through the interface provided by the cover.").

By contrast Dr. Madisetti testifies that "a convex surface condenses light away from the periphery and towards the sensor's center." Ex. 2004 ¶ 73. We have considered this testimony; however, Dr. Madisetti's opinions largely are premised upon the behavior of collimated and perpendicular light as depicted in Figure 14B of the challenged patent. *See id.* Dr. Madisetti does not persuasively explain how light would behave when approaching the sensor from various angles, as it would after being reflected by tissue. *Id.* ¶¶ 71–75. In other words, even if Patent Owner is correct that the '553 patent's Figure 14B depicts light condensing toward the center, this is not dispositive to the proposed modification, because light passing through a user's tissue is scattered and random, and is not collimated and perpendicular as shown in Figure 14B. Ex. 1001, Fig. 14B.

Patent Owner and Dr. Madisetti argue that "Petitioner and Dr. Kenny both previously admitted that a convex cover condenses light towards the center of the sensor and away from the periphery in a different petition filed against a related patent," i.e., in IPR2020-01520. PO Resp. 31–32; Ex. 2004 ¶¶ 71–72 (citing Ex. 2019, 45; Ex. 2020 ¶¶ 69–70). The cited portions of the Petition and Dr. Kenny's declaration from IPR2020-01520 discuss a decrease in the "mean path length" of a ray of light when it travels through a convex lens rather than through a flat surface. *See, e.g.*, Ex. 2020 ¶¶ 118–120. We do not agree that this discussion is inconsistent with Dr. Kenny's testimony here that, where light is reflected to the detectors at various random angles and directions, more light will reach Mendelson-799's symmetrically disposed detectors when travelling through the convex surface than would be reached without such a surface, because light that might have otherwise missed the detectors now will be captured. Ex. 1047 ¶¶ 43–45. We do not discern that the convergence of a single ray of light toward the center, as discussed in IPR2020-01520, speaks to the aggregate effect on *all* light that travels through the convex surface. Patent Owner suggests that this prior discussion means that all light is always directed toward the center regardless of where or how the light approaches the convex surface (PO Resp. 31–33), however, we do not understand Dr. Kenny's testimony to support such a position.

In its Sur-reply, Patent Owner argues that it "never argued that all incoming light condenses to a ***single point***," or "that ***all*** light would be focused at the center." Sur-reply 16–17. Be that as it may, neither Patent Owner nor Dr. Madisetti sufficiently addresses the diffuse nature of the light at issue here, which reflects from user tissue and scatters. Patent Owner

attempts to do so in its Sur-reply, stating that "light entering the convex surface from all angles would, on average, result in more light directed towards the center and less light at the periphery—as compared to a flat surface—and therefore less light at the peripherally located detectors." *Id.* at 17 (emphases omitted). However, as support, Patent Owner identifies only the same portions of Dr. Madisetti's declaration discussed above, which fail to address diffuse or scattered light. Ex. 2004 ¶¶ 70–75. Accordingly, considering all evidence of record, we credit the testimony of Dr. Kenny.[6]

With respect to Patent Owner's fourth argument, we do not agree that a person of ordinary skill in the art would have been discouraged from modifying Mendelson-799 as proposed, due to the potential for air gaps to form at the peripheral edges of the convex surface. PO Resp. 36–38. Patent Owner misstates the proposed modification. Petitioner does not propose "modif[ying] Mendelson[-]799's structure to add Ohsaki's air gaps." *See* PO Resp. 37. Petitioner proposes modifying Mendelson-799 only to include a cover with a convex surface; Petitioner does not propose including any air gaps that may be present in Ohsaki. *See, e.g.*, Pet. 41. Moreover, even if Ohsaki's Figure 1 depicts small air gaps adjacent the convex surface, Ohsaki nonetheless discloses that the convex surface is in "intimate contact" with the user's skin. Ex. 1009 ¶ 25; *see also Hockerson-Halberstadt*, 222 F.3d at 956. In view of such a teaching, we agree with Petitioner that it would have

[6] Moreover, we disagree with Patent Owner's argument that Petitioner's Reply arguments are overly complex and instead a person of ordinary skill in the art "would have understood and applied the straightforward understanding that a convex surface condenses light toward the center." Sur-reply 19–20. As noted above, this "straightforward understanding" lacks sufficient support, in the context of diffuse light.

been within the skill of a person of ordinary skill in the art, who "is also a person of ordinary creativity, not an automaton," to minimize any such air gap that may be present when including a cover with a convex surface in Mendelson-799's sensor. Indeed, a purpose of Petitioner's proposed modification is to increase signal strength. *See, e.g.*, Pet. 24–25. We discern that it would have been within the capability of an ordinarily skilled artisan to eliminate any air gap that would have decreased signal strength or quality. Ex. 1047 ¶ 48.

Rationale 3

Petitioner further contends that a person of ordinary skill in the art "would have recognized that a light permeable cover with a protruding convex surface," such as that taught by Ohsaki, would "protect the elements within sensor housing 17" of Mendelson-799. Pet. 21–22. We are persuaded that adding a convex cover, such as that taught by Ohsaki, would protect the sensor's internal components. Mendelson-799 is not shown to include a cover over its emitters 12a–c or detectors 16, 18. *See, e.g.*, Ex. 1012, Fig. 7. By contrast, Ohsaki discloses that translucent board 8 with its convex surface covers its emitter and detector. As such, we credit Dr. Kenny's testimony that a person of ordinary skill in the art would have been motivated to add a transparent convex cover to Mendelson-799 to "provide additional protection to the elements accommodated within sensor housing 17." Ex. 1003 ¶ 87.

We disagree with Patent Owner's fifth argument that a person of ordinary skill in the art would not have modified Mendelson-799 as proposed because a convex cover would be prone to scratches and because other alternatives existed. PO Resp. 38–49. Patent Owner's counsel did not

dispute, during the oral hearing, that a convex cover would indeed serve to protect the internal sensor components in Mendelson-799, as Petitioner proposes. Tr. 64:6–65:5 (but noting that a flat cover would also protect, and would be less prone to scratches). Even if a convex cover seated against the skin may be more prone to scratches than a flat cover, this is just one of numerous tradeoffs that a person of ordinary skill in the art would consider, in determining whether the benefits of increased adhesion, signal strength, and protection outweigh the potential for a scratched cover. *Medichem*, 437 F.3d at 1165. We do not agree that the possibility of scratches alone would have dissuaded a person of ordinary skill in the art from the proposed modification, to achieve the benefits identified by Petitioner.

For the foregoing reasons, we are persuaded by Petitioner's contentions.

v. Summary

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 1 would have been obvious over the cited combination of references.

4. Independent claims 10 and 20

Independent claims 10 and 20 consist of limitations that are substantially similar to elements [a]–[d] of claim 1. *Compare* Ex. 1001, 44:50–67, *with id.* at 45:35–47 *and id.* at 46:22–46. In asserting that claims 10 and 20 also would have been obvious over the combined teachings of Mendelson-799 and Ohsaki, Petitioner refers to the same arguments presented as to claim 1. *See* Pet. 45–50, 55–60.

Patent Owner does not separately address independent claims 10 and 20. *See generally* PO Resp.

We have examined the scope of claims 10 and 20 as well as Petitioner's unrebutted contentions concerning these two claims. Claim 10 is generally broader in scope than claim 1, but otherwise claims the same elements in the same configurations as examined above. *See* Pet. 45–50. One distinction is that "at least four detectors" must be "operably arranged on the planar surface of the substrate *in a pattern*." Ex. 1001, 45:35–47. Petitioner establishes how "the Mendelson-Ohsaki combination would have included twelve discrete detectors that are operably arranged on the planar surface of the sensor's substrate in a radially symmetric pattern around central light source 12." Pet. 49.

Claim 20 is also very similar to claim 1. *See id.* at 55–60. Claim 20 additionally requires "positioning the at least four detectors within *one or more spaces* formed by at least the substrate." Ex. 1001, 46:44–46. Petitioner also establishes how "the discrete detectors included within detectors 16 and 18 would have been positioned within spaces formed by the substrate, wall, and cover." Pet. 60 (citing Ex. 1003 ¶¶ 199–200).

Based on Petitioner's analysis and supporting testimony of Dr. Kenny, and for the same reasons discussed above, we are persuaded that Petitioner's cited evidence and reasoning demonstrates by a preponderance of the evidence that claims 10 and 20 would have been obvious over Mendelson-799 and Ohsaki. *See supra*.

5. Dependent claim 2

Dependent claim 2 depends from independent claim 1 and further recites: "The noninvasive optical physiological sensor of claim 1, wherein

the wall operably connects to the substrate on one side and operably connects to the cover on an opposite side." Ex. 1001, 45:1–3.

Petitioner primarily relies on its analysis of claim 1, citing to argument and evidence demonstrating how a person of ordinary skill in the art would understand that "the wall operably connects to the substrate on one side and operably connects to the cover on an opposite side," as claimed. Pet. 42 (citing Ex. 1003 ¶¶ 55–69, 78–138; Ex. 1012, code (57), 4:13–22, 7:25–8:13, 8:37–41, 9:22–10:30, Figs. 7, 8; Ex. 1009 ¶¶ 15, 17, 25, Figs. 1, 2, 4A, 4B).

Patent Owner argues that "Petitioner provides no independent analysis for this claim and instead refers back to analyses of claim 1." PO Resp. 41. Patent Owner also argues that, in the annotated figures, Petitioner relies on "a combination with cover and wall features that are unsupported and unexplained," and that Petitioner does not have support for placing a cover spanning the entire space above the substrate and for providing notches. *Id.* at 41–43.

We have addressed Patent Owner's concerns in our analysis above. As shown in the Petitioner's modified figures (*see* Pet. 41), the wall of the combined sensor surrounds the sensor components and is operably connected to the convex cover on the top and is operably connected to the planar substrate on the bottom, as claimed. Moreover, as discussed above regarding claim 1, Petitioner's proposed modifications to Mendelson-799 is not premised upon bodily incorporating Ohsaki's cover directly with Mendelson-799's sensor. *See In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) ("Combining the teachings of references does not involve an ability to combine their specific structures.").

To the contrary, Petitioner proposes incorporating Ohsaki's teaching of a cover with a convex surface, not the precise cover and structure disclosed by Ohsaki. Ex. 1003 ¶ 88 ("And, consistent with Ohsaki's configuration, one of ordinary skill would have configured Mendelson '799's circumscribing wall to operably connect, on one side, to the planar substrate on which detectors 16 and 18 are arranged and, on an opposite side, to the convex cover.");*see also* Ex. 1012, code (57), 9:22–10:30, Fig. 7; Ex. 1009 ¶ 17, Fig. 2; *see also* Ex. 1047 ¶ 11 ("one of ordinary skill in the art would arrange for a convex cover based on the teaching of Ohsaki that was the right size to fit with the housing of Mendelson '799"). If Ohsaki's teaching is implemented in a manner that varies from the precise implementation of such a cover in Ohsaki, e.g., with a larger span or with notches, this is not a material deviation from Ohsaki's express teachings of using a cover with a convex surface to achieve specific benefits, e.g., improved adhesion and signal strength. Ex. 1009 ¶ 25; *see supra*; *see Lear Siegler, Inc. v. Aeroquip Corp.*, 733 F.2d 881, 889 (Fed. Cir. 1984) (explaining that a person of ordinary skill is not "compelled to adopt every single aspect of [a reference] without the exercise of independent judgment").

Accordingly, for the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claim 2 would have been obvious over the cited combination of references.

6. Dependent claims 3, 5, 6, 9, 11–18, 21–24, 29

Petitioner also contends that claims 3, 5, 6, 9, 11–18, 21–24, and 29 would have been obvious based on the same combination of prior art addressed above. These challenged claims all depend directly or indirectly

from independent claim 1, 10, or 20. Petitioner identifies teachings in the prior art references that teach or suggest the limitations of these claims, and provides persuasive reasoning as to why the claimed subject matter would have been obvious to one of ordinary skill in the art. Pet. 29–62. Petitioner also supports its contentions for these claims with the testimony of Dr. Kenny. Ex. 1003 ¶¶ 139–211.

Patent Owner does not present any arguments for these claims other than those we have already considered with respect to independent claim 1. PO Resp. 41 ("The Petition fails to establish that independent claims 1, 10, and 20 are obvious over the cited references of Ground 1 and therefore fails to establish obviousness of any of the challenged dependent claims."); *see supra*.

We have considered the evidence and arguments of record and determine that Petitioner has demonstrated by a preponderance of the evidence that claims 3, 5, 6, 9, 11–18, 21–24, and 29 would have been obvious over the combined teachings of Mendelson-799 and Ohsaki, for the reasons discussed in the Petition and as supported by the testimony of Dr. Kenny.

7. Conclusion

For the foregoing reasons, we determine that Petitioner has met its burden of demonstrating by a preponderance of the evidence that claims 1–3, 5, 6, 9–18, 20–24, and 29 would have been obvious over the cited combination of references.

E. Obviousness over the Combined Teachings of Mendelson-799, Ohsaki, and Schulz

Petitioner contends that claims 4, 18, and 24 of the '553 patent would have been obvious over the combined teachings of Mendelson-799, Ohsaki, and Schulz. Pet. 62–74. Patent Owner disagrees and presents several arguments, including that "a POSITA would not have been motivated to combine Schulz with Mendelson '799 and Ohsaki." PO Resp. 43, 43–45; *see also generally* Sur-reply.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of evidence that claims 4, 18, and 24 are unpatentable.

1. Overview of Schulz (Ex. 1013)

Schulz is a U.S. patent application publication titled "Pulse Oximetry Ear Sensor," and discloses an ear sensor assembly including an emitter pad and a detector pad. Ex. 1013, codes (54), (57).

Figure 19C of Schulz is reproduced below.

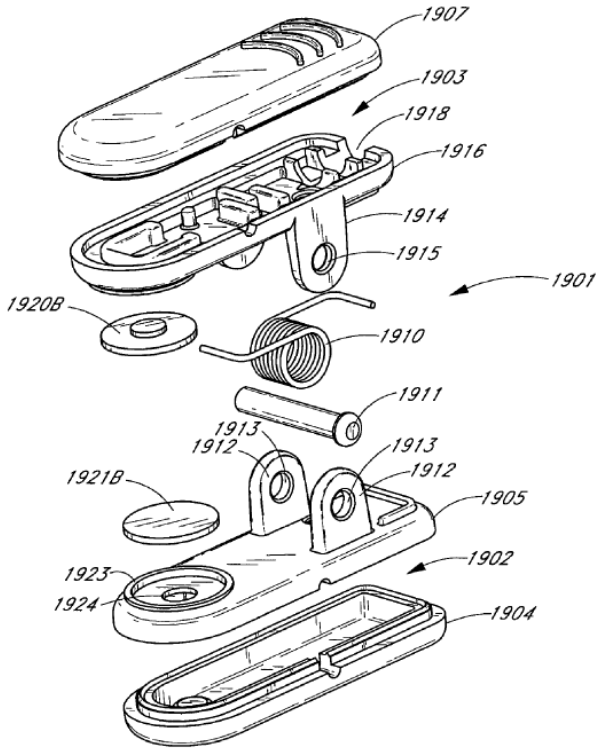


Figure 19C illustrates an exploded top perspective view of an ear sensor clip. *Id.* ¶ 31. Each sensor clip 1900 includes "opposingly positioned housings 1902 and 1903 that house one or more sensor optical components." *Id.* ¶ 65. Each housing includes respective inward facing shells 1905 and 1906.[7] *Id.* ¶ 65. "[I]nward facing shells 1905 and 1906 further include windows 1919 and 1924 that provide an aperture for transmission of optical energy to or from a tissue site. Translucent silicone material covers windows 1919 and 1924 providing lenses 1920 and 1921." *Id.* ¶ 67.

A "thin sheet of opaque material is located beneath window 1919 or 1924, and a window in the opaque material provides an aperture for transmission of optical energy to or from the tissue site." *Id.* ¶ 73. "The opaque material blocks light, and the window in the opaque material can be

[7] Figure 19C appears to label inward facing shell 1906 as 1916. *See id.* at Fig. 19B.

sized as needed to block the proper amount of light from entering the aperture to, for example, avoid saturation of the light detector." *Id.*

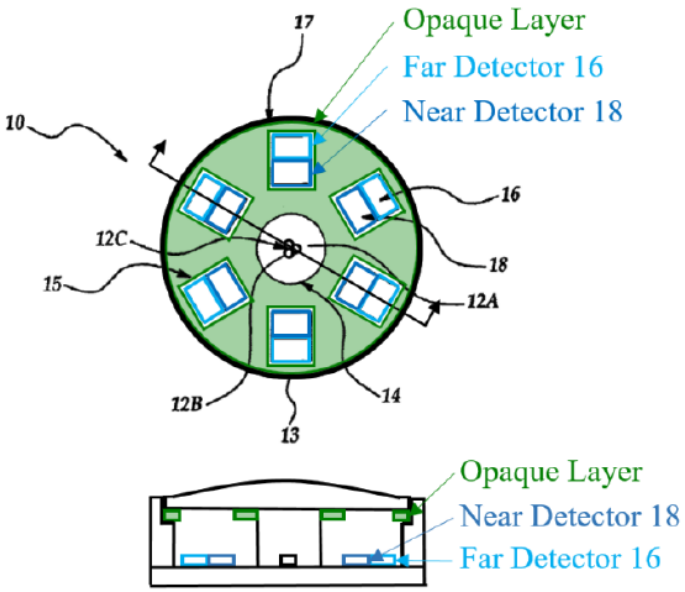
2. Dependent Claims 4, 18, and 24

Claim 4 requires "an opaque layer blocking light other than at one or more openings that allow light to pass through to at least one of the at least four detectors." Ex. 1001, 45:7–11. Claims 18 and 24 similarly require "one or more openings that allow light to pass through to the at least four detectors." *Id.* at 46:7–10, 60–63.

Petitioner's Disputed Contentions

Petitioner identifies teachings in the prior art references that teach the limitations of each of dependent claims 4, 18, and 24, and provides persuasive reasoning as to why the claimed subject matter would have been obvious to one of ordinary skill in the art. Pet. 65–74. More specifically, Petitioner contends that a person of ordinary skill in the art would have combined Mendelson-'799 and Ohsaki with Schulz to obtain additional benefits. *Id.* at 65. Petitioner contends "a POSITA would have recognized that the Mendelson-Ohsaki opaque wall would partially shield the detectors from ambient light, but would have understood from Schulz that additional measures could be taken to guard against saturation." *Id.* (citing Ex. 1019, 79, 86, 94). Petitioner relies on Schulz's sensor featuring a thin sheet of opaque material placed inside the sensor's housing beneath a lens with "a window in the opaque material provid[ing] an aperture for transmission of optical energy to or from the tissue site," as well as the sizeable opaque material blocking light from entering the aperture to avoid saturation of the light detector. *Id.* at 66 (quoting Ex. 1013 ¶ 73, Figs. 19A–19C).

Petitioner contends that a person of ordinary skill in the art would have been motivated to add a layer of opaque material to the Mendelson-Ohsaki sensor, and to size windows in the opaque material as appropriate, to avoid saturation of each of the sensor's detectors. *Id.* (citing Ex. 1003 ¶¶ 215–216; Ex. 1013 ¶ 73, Figs. 19A–19C). Petitioner argues that based upon the knowledge a person of skill in the art would possess, and based on Schulz's description, "Schulz's opaque layer limits errors by decreasing the angle of incidence to the photodiode to that enabled by the window included within the layer, and by otherwise preventing ambient light from reaching the photodiode." *Id.* at 67. Petitioner similarly argues that a person of ordinary skill in the art would have applied Schulz's teachings to pulse oximetry sensors featuring multiple photodiodes so that errors could be limited using an opaque layer with multiple windows, the windows being configured to decrease the angles of incidence to the photodiodes. *Id.* Relying on the annotated Figure 7 of Mendelson-'799 below, Petitioner argues that "Schulz would have motivated a POSITA to modify the Mendelson-Ohsaki combination to include an opaque layer that would have blocked light other than at windows corresponding to the sensor's photodiodes." *Id.* at 69.



Petitioner's annotated Figure 7 of Mendelson-799 and added sectional view depicting an additional "Opaque Layer" (illustrated in green) having windows. Pet. 70. According to Petitioner, "the Mendelson-Ohsaki-Schulz combination improves upon the Mendelson-Ohsaki combination by adding a well-known component, an opaque layer that blocks light other than at windows corresponding to the detectors, in order to 'avoid saturation' of the detectors." Pet. 70–71 (citing Ex. 1003 ¶ 222; Ex. 1013 ¶ 73). Thus, Petitioner concludes that "the Mendelson-Ohsaki-Schulz combination would have included an opaque layer blocking light other than at one or more openings that allow light to pass through to the twelve detectors." Pet. 71 (citing Ex. 1003 ¶¶ 55–72, 78–136, 213–222).

Patent Owner's Arguments

Patent Owner, relying on the testimony of Dr. Madisetti, argues that "a POSITA would *not* have been motivated to combine Schulz with Mendelson '799 and Ohsaki." PO Resp. 44 (citing Ex. 2004 ¶¶ 89–93). Patent Owner first argues aspects of Schulz individually. For example, Patent Owner argues that Schulz is directed to an ear sensor, but the

Mendelson-Ohsaki combination is not, and Mendelson-799 contrasts its reflectance sensor with transmission sensors attached on an earlobe. PO Resp. 44 (citing, e.g., Ex. 2004 ¶ 90). Patent Owner next contends that "there is no evidence over-saturation was a problem for the detectors in either Mendelson '799 or Ohsaki." *Id.*

Patent Owner further argues that a person of ordinary skill in the art would not have been motivated to modify Mendelson-799 as proposed because adding an opaque layer would *decrease* signal strength, especially for a reflectance pulse oximeter like Mendelson-799, which Patent Owner alleges has a weak signal already. PO Resp. 44–45 (citing, e.g., Ex. 2004 ¶¶ 91–93); Sur-reply 25–26. According to Patent Owner, a person of ordinary skill in the art would not have been motivated to add features that make an already weak signal even weaker, especially at "Petitioner's proposed wrist-worn sensor—a location where a POSITA would expect weak and noisy signals." Sur-reply 25–26. Further, "[n]othing in Schulz would have motivated a POSITA to add windows to Mendelson '799's sensor to block ambient light," whereas "other cited Mendelson references similarly place the sensor inside an opaque cover that would likewise suppress ambient light," according to Patent Owner. *Id.* at 26. Finally, Patent Owner asserts that a person of ordinary skill in the art would have expected the windows in Petitioner's proposed combination to prevent the necessary angular reflected light from reaching Mendelson-799's detectors, thereby making an already weak signal even weaker. PO Resp. 44–45 (citing Ex. 2004 ¶¶ 91–92).

Analysis

We have considered the parties' arguments and cited evidence, and we are persuaded by Petitioner's contentions. As discussed above, Schulz explicitly teaches that its opaque material and window "blocks light" and "avoid[s] saturation of the light detector." Ex. 1013 ¶ 73. Petitioner cites persuasive and well-supported evidence, including the testimony of its declarant, that a person of ordinary skill in the art would have been motivated to add such an arrangement to the sensor of Mendelson-799 to achieve this same disclosed benefit, i.e., to avoid saturation of Mendelson's detectors. *See, e.g.*, Ex. 1003 ¶¶ 215–216. For example, Dr. Kenny's testimony regarding the ability of an opaque material with windows to avoid saturation is supported by Schulz and by the Webster textbook, which discusses the importance of minimizing "light other than the optical signals of interest." *Id.* ¶ 217 (citing Ex. 1019, 76). We are persuaded by Petitioner's contentions and Dr. Kenny's testimony.

We do not agree with Patent Owner's argument that this modification would *decrease* signal strength. PO Resp. 44–45. We discern that Petitioner's proposed modification would not alter the signal of interest, i.e., the optical signal that passes from the emitter, through the user's tissue, and to the photodetectors. Rather, the cited evidence of record supports Petitioner's contention that the proposed modification would have blocked light *other than* that from the signal of interest, i.e., the emitter. *See, e.g.*, Ex. 1003 ¶ 221 ("Schulz would have motivated one of ordinary skill to modify the Mendelson-Ohsaki combination to include an opaque layer that would have blocked light other than at windows corresponding to the sensor's photodiodes."); Ex. 1013 ¶ 73 ("The opaque material blocks light,

and the window in the opaque material can be sized as needed to block the proper amount of light from entering the aperture to, for example, avoid saturation of the light detector."); *see also* Pet. Reply 24–26. Thus, we do not agree that the proposed modification would have decreased signal strength.

We have considered Patent Owner's similar argument that the proposed windows would have prevented certain angular reflected light from reaching Mendelson-799's detectors, thereby making an already weak signal even weaker. Sur-reply 27 (citing, e.g., Ex. 2004 ¶¶ 91–92). We do not find any support for this argument in Schulz. To the contrary, Schulz explains that "the window in the opaque material can be sized as needed to block the proper amount of light from entering the aperture to, for example, avoid saturation of the light detector." Ex. 1013 ¶ 73. Contrary to Patent Owner's argument, Schulz simply states that its window is sized to control the amount of light *that enters the aperture*; Schulz does not state where that light comes from, or that it only controls against light from the emitter.

We also do not agree with Patent Owner's argument that Petitioner has not shown that saturation was a problem for Mendelson-799's sensor. PO Resp. 44. Mendelson-799 need not identify a problem with saturation in order to be improved by the proposed modification. Indeed, Petitioner "does not need to show that there was a known problem with the prior art system." *Unwired Planet, LLC v. Google Inc.*, 841 F.3d 995, 1002–03 (Fed. Cir. 2016); *see also Sci. Plastic Prods., Inc. v. Biotage AB*, 766 F.3d 1355, 1359–61 (Fed. Cir. 2014); *Hologic, Inc. v. Minerva Surgical, Inc.*, 764 F. App'x 873, 880 (Fed. Cir. 2019). As expressly recognized in *KSR*, *any* art-recognized need or problem can provide a reason for combining claim

elements. *KSR*, 550 U.S. at 416. Here, Petitioner provides sufficient evidence to demonstrate that saturation was a known problem (*see, e.g.*, Ex. 1003 ¶¶ 216–220; Ex. 1019, 79; Ex. 1023, 11–12;[8] Ex. 1047 ¶¶ 63, 64) and that Schulz provided a readily-applicable technique to solve it (Ex. 1013 ¶ 73).

We also do not agree with Patent Owner's argument that Schulz and Mendelson-799 are incompatible because they obtain measurements at different locations. Mendelson-799 explains that its sensor type can be used in "multiple convenient locations on the body," and does not exclude use on a patient's ear or elsewhere. Ex. 1012, 2:15–21; *see also* Ex. 1019, 104 ("The idea of using skin reflectance spectrophotometry marked a significant advancement in the noninvasive monitoring of $Sa0_2$ from virtually any point on the skin surface."). Moreover, the proposed modification does not seek to bodily incorporate the references, one with the other. Rather, Petitioner clearly proposes modifying Mendelson-799 to include an opaque material with windows, as taught by Schulz, but plainly does not propose incorporating any other aspect of Schulz, such as its measurement location. *See* Pet. 47–49; *see also In re Nievelt*, 482 F.2d 965, 968 (CCPA 1973) ("Combining the teachings of references does not involve an ability to combine their specific structures.").

[8] It is of no moment that this evidence is not identified as part of the asserted ground. PO Resp. 45. This evidence is cited by Dr. Kenny as support for his testimony, consistent with our rules. 37 C.F.R. § 42.65(a) ("Expert testimony that does not disclose the underlying facts or data on which the opinion is based is entitled to little or no weight.").

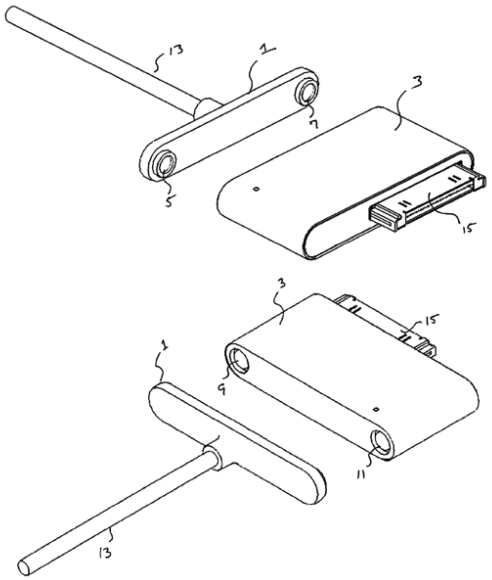
F. Obviousness over the Combined Teachings of Mendelson-799, Ohsaki, and Griffin

Petitioner contends that claim 25 of the '553 patent would have been obvious over the combined teachings of Mendelson-799, Ohsaki, and Griffin. Pet. 74–79. Patent Owner disagrees and offers several reasons why a person of ordinary skill in the art would not have been motivated to combine Mendelson-799 and Ohsaki with Griffin. PO Resp. 46–47.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of evidence that claim 25 is unpatentable.

1. Overview of Griffin (Ex. 1014)

Griffin is titled "Magnetic Connector" and it relates to a connector that "uses complimentary magnetic arrays and mating surfaces on its plug and receptacle," as shown in Figures 1(a) and 1(b) reproduced below. Ex. 1014, codes (54), (57).



Figures 1(a) and 1(b) of Griffin show complimentary magnetic arrays and mating surfaces. Figures 1(a) and 1(b) also depict an electrical magnetic connector featuring "a plug having a plug magnet and plug face and a receptacle having a receptacle magnet and receptacle face." *Id.* at 1:54–2:18, 3:26–61, Figs. 1(a)–1(c).

Griffin's connection mechanism addresses problems that arise when, for example, "connectors are sometimes inadvertently decoupled," which can "result in a broken connector or even damage to the connected electronic device." *Id.* at 1:29–42. Griffins' plug and receptacle magnets allow for a quick and safe decouple when a sudden force is applied without resulting in any damage to the connector or the associated electronic device. *Id.* at 3:48–53, 5:26–38.

2. Dependent claim 25

Dependent claim 25 further requires: "a magnet configured to be used as a connecting mechanism." Ex. 1001, 4:64–67.

Undisputed Contentions

Griffin's teaching of a magnet configured to be used as a connecting mechanism is not disputed by Patent Owner. *See* PO Resp. 46 ("Griffin is a plug that 'uses complementary magnetic arrays and mating surfaces . . . to facilitate connection and disconnection of the ***connector***.'" (citing Ex. 1014, code (57)); Ex. 1003 ¶¶ 73–74.

Petitioner's Disputed Contentions

Petitioner proposes that a person of ordinary skill in the art would have been motivated to combine Mendelson-799 and Ohsaki with Griffin to obtain certain benefits. Pet. 77 (citing Ex. 1003 ¶¶ 246–247). Mendelson-799 identifies pulse oximeter 20 including "a control unit 21, which is

composed of an electronic block 22 including A/D and D/A converters connectable to the sensor 10." Pet. 76 (quoting Ex. 1012, 10:16–22). Petitioner contends that "Mendelson-799 does not explicitly describe the mechanism for connecting sensor 10 and electronic block 22 as a magnet but, in view of Griffin's disclosure, a POSITA would have found it obvious to implement that connection with a magnet configured to be used as a connecting mechanism." Pet. 77 (citing Ex. 1003 ¶ 248).

Petitioner contends that it was well known by the critical date that electrical connectors relying on a mechanical or friction fit to couple a plug to a receptacle were sometimes subject to inadvertent decoupling, and that such decoupling could result in broken connectors and devices. *Id.* (citing Ex. 1003 ¶ 249; Ex. 1014, 1:29–50). As such, Petitioner argues that a person of ordinary skill in the art would have understood that this problem could be solved with Griffin's magnetic connector, and integrating it into the Mendelson-799 and Ohsaki combination would have avoided problems that might arise from a sudden or forceful decoupling of the connection between sensor 10 and electronic block 22. Pet. 77–78 (citing Ex. 1003 ¶ 249; Ex. 1014, 1:54–2:18, 3:26–61, 5:26–38, Figs. 1(a)–1(c)).

Patent Owner's Arguments

Patent Owner contends that "[c]laim 25 is not obvious because a POSITA would not have been motivated to combine Griffin with Mendelson '799 and Ohsaki." PO Resp. 46 (citing Ex. 2004 ¶¶ 94–95). Patent Owner argues that Griffin uses magnetic arrays for connection to address the problem of inadvertently decoupled connectors, yet Petitioner's proposed combination of Mendelson-799 and Ohsaki would be a self-contained device attached to the user's wrist with a belt. *Id.* Thus, according to Patent

Owner, the person of ordinary skill in the art would not have been motivated to make the combination because "[t]he device has ***no*** attached cables that could be inadvertently decoupled," and "Petitioner never explains why a POSITA would have looked to Griffin to address decoupling issues when the combination of Mendelson '799 and Ohsaki has no cables to decouple." *Id.* (citing Ex. 2004 ¶ 95). Patent Owner contends that "Petitioner's combination has neither the need nor the opportunity for Griffin's magnetic connections to attached cables." Sur-reply 28.

Analysis

Petitioner has persuasively established why a person of ordinary skill in the art would have been motivated to modify the Mendelson-Ohsaki sensor such that the mechanism for connecting sensor 10 and electronic block 22 is implemented using a magnet, as taught by Griffin. *See* Pet. 76–78. Patent Owner's argument is premised on the proposed device always being "self-contained," and such a device never having the need to integrate a magnetic connector to avoid problems that might arise from a forceful decoupling. We disagree.

Patent Owner bases its argument on Ohsaki's device allegedly including "a display and electrical connections ***within the sensor body itself***." PO Resp. 46. Petitioner's description of the proposed combination, however, explains that Mendelson-799's pulse oximeter 20 includes "control unit 21, which is composed of an electronic block 22 including A/D and D/A converters connectable to the sensor 10." Pet. 76 (quoting Ex. 1012, 10:16–22). We agree with Petitioner that control unit 21 and sensor 10 would have been connected such that a person of ordinary skill in the art would have

been motivated to integrate Griffin's magnetic connection to avoid forceful decoupling. Pet. Reply 28 (citing e.g., Ex. 1003, 246–251).

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of evidence that claim 25 is unpatentable.

G. Obviousness over the Combined Teachings of Mendelson-799, Ohsaki, and Mendelson-2006

Petitioner contends that claims 7 and 19 of the '553 patent would have been obvious over the combined teachings of Mendelson-799, Ohsaki, and Mendelson-2006. Pet. 79–96. Patent Owner disagrees and presents several arguments against the proposed combination. PO Resp. 47–50.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of evidence that claims 7 and 19 are unpatentable.

1. Overview of Mendelson-2006 (Ex. 1010)

Mendelson-2006 is a journal article titled "A Wearable Reflectance Pulse Oximeter for Remote Physiological Monitoring," and discloses a wireless wearable pulse oximeter connected to a personal digital assistant ("PDA"). Ex. 1010, 1.[9]

[9] Petitioner cites to the page numbers added to Exhibit 1010, rather than the native page numbering that accompanies the article. We follow Petitioner's numbering scheme.

Figure 1 of Mendelson-2006 is reproduced below.

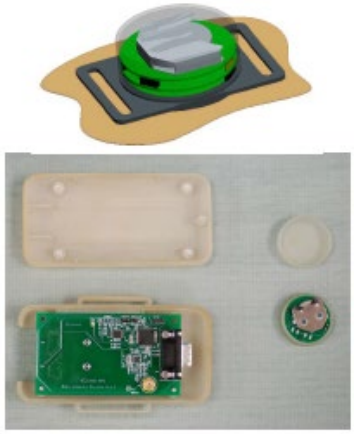


Figure 1 illustrates a sensor module attached to the skin (top), and a photograph of a disassembled sensor module and receiver module (bottom). The sensor module includes an optical transducer, a stack of round printed circuit boards, and a coin cell battery. *Id.* at 2.

Figure 2 of Mendelson-2006 is reproduced below.

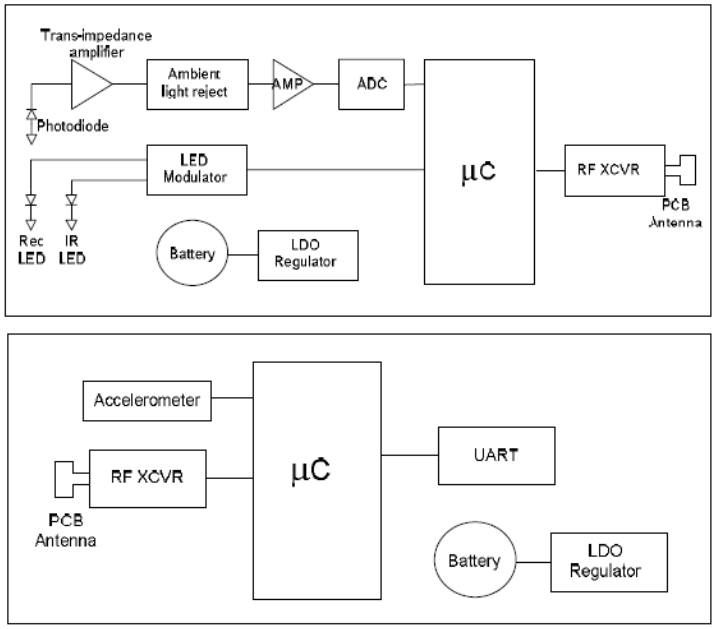


Figure 2 depicts a system block diagram of the wearable, wireless, pulse oximeter including the sensor module (top) and the receiver module (bottom). *Id.* The sensor module includes at least one light-emitting diode

("LED"), a photodetector, signal processing circuitry, an embedded microcontroller, and an RF transceiver. *Id.* at 1–2. Mendelson-2006 discloses that a concentric array of discrete photodetectors could be used to increase the amount of backscattered light detected by a reflectance type pulse oximeter sensor. *Id.* at 4. The receiver module includes an embedded microcontroller, an RF transceiver for communicating with the sensor module, and a wireless module for communicating with the PDA. *Id.* at 2.

As a PDA for use with the system, Mendelson-2006 discloses "the HP iPAQ h4150 PDA because it can support both 802.11b and Bluetooth™ wireless communication" and "has sufficient computational resources." *Id.* at 3. Mendelson-2006 further discloses that

> [t]he use of a PDA as a local terminal also provides a low-cost touch screen interface. The user-friendly touch screen of the PDA offers additional flexibility. It enables multiple controls to occupy the same physical space and the controls appear only when needed. Additionally, a touch screen reduces development cost and time, because no external hardware is required. . . . The PDA can also serve to temporarily store vital medical information received from the wearable unit.

Id.

The PDA is shown in Figure 3 of Mendelson-2006, reproduced below.

Figure 3 illustrates a sample PDA and its graphical user interface ("GUI"). *Id.* Mendelson-2006 explains that the GUI allows the user to interact with the wearable system. *Id.* "The GUI was configured to present the input and

output information to the user and allows easy activation of various functions." *Id.* "The GUI also displays the subject's vital signs, activity level, body orientation, and a scrollable PPG waveform that is transmitted by the wearable device." *Id.* For example, the GUI displays numerical oxygen saturation ("SpO_2") and heart rate ("HR") values. *Id.*

2. Dependent claims 7 and 19

Dependent claims 7 and 19 further require "a touch screen display," as well as "one or more processors" configured to receive data or signals from the four detectors, among other limitations. Ex. 1001, 45:18–28, 46:11–21.

Petitioner's Contentions

Petitioner first notes that the Mendelson-799 and Ohsaki combination would have included an optical sensor 10 for use in the proposed optical measurement device to measure a blood parameter. Pet. 81. Petitioner relies on the control unit of Mendelson-799 with electronic block 22 connectable to sensor 10, microprocessor 24 for analyzing measured data, and display 26 for presenting measurement results. Pet. 83. Petitioner contends that Mendelson-799 "describes a physiological monitoring device that includes both noninvasive optical physiological sensor 10 and pulse oximeter 20 with display 26 that is configured to utilize sensor 10." Pet. 83–84.

Petitioner observes that Mendelson-799 does not explicitly describe pulse oximeter 20's display 26 as a touch-screen display, but Petitioner contends that a person of ordinary skill in the art would have found it obvious to implement display 26 as a touch-screen display in light of the teachings of Mendelson-2006. Petitioner relies on the advantages of integrating a touch screen display described in Mendelson-2006, such as providing a low-cost touch screen interface and a simple GUI that presents

input and output information to the user to allow easy activation of various functions. Pet. 85. "To enable easy activation of various functions through a user-friendly interface similar to that described by Mendelson 2006, a POSITA would have found it obvious to implement pulse oximeter 20's display 26 as a touch-screen display." Pet. 86 (citing Ex. 1003 ¶¶ 265–268).

Petitioner next argues that a person of ordinary skill in the art would have found it obvious to enable Mendelson-799 and Ohsaki's sensor and pulse oximeter to communicate wirelessly with a PDA featuring a touch-screen display or mobile phone functionality in view of the teachings of the Mendelson-2006 disclosure. Pet. 86 (citing Ex. 1003 ¶ 269). Petitioner notes that at the time of invention, physiological sensor devices commonly communicated wirelessly with handheld computing devices. *Id.* Petitioner notes that Mendelson-2006's sensor module includes an "optical reflectance transducer" for measuring photoplethysmographic (PPG) signals, and the receiver module includes "an embedded microcontroller." Pet. 87 (quoting Ex. 1010, 1–2). Next, Petitioner shows how signals acquired by the Sensor Module of Mendelson-2006 are received by the embedded microcontroller which synchronously converts the corresponding output to various signals that are filtered by software to compute arterial oxygen saturation (SpO_2) and heart rate (HR) based on the relative amplitude and frequency content of the reflected PPG signals. *Id.* Petitioner relies on Mendelson-2006's disclosure of transmitting information acquired by the Sensor Module wirelessly via an RF link over a short range to a body-worn Receiver Module and data processed by the receiver module is transmitted wirelessly to a PDA. Pet. 88 (citing Ex. 1010, 2, Fig. 2). Petitioner contends that Mendelson-2006's PDA is a simple low-cost GUI that presents input and

output information to the user, which allows "easy activation of various functions" and a person of ordinary skill in the art would have recognized the benefit of adding these features into the Mendelson-799 and Ohsaki system. Pet. 88–89, 90 ("POSITA would have been motivated to wirelessly transmit information or data acquired or processed by sensor 10 and pulse oximeter 20 to a PDA featuring a touch-screen display and/or mobile phone functionality").

Patent Owner Contentions

Patent Owner, relying on the testimony of Dr. Madisetti, contends that a person of ordinary skill in the art "would have been led away from Petitioner's proposed combination as a whole" after reviewing the complete disclosure of Mendelson-2006. PO Resp. 48 (citing Ex. 2004 ¶¶ 96–102).

First, Patent Owner argues that Mendelson-2006's sensor uses a single detector ring and not multiple detectors as claimed. *Id.* (citing Ex. 1010, 1, 4). Further, the single photodetector ring increases the amount of backscattered light captured and also reduces power consumption, according to Patent Owner, such that a person of ordinary skill in the art "would have recognized that a single photodetector ring reduces power consumption because it maximizes the amount of light detected by eliminating the space between the individual detectors of Mendelson '799." *Id.*

Second, Mendelson-2006's device positions the sensor on the user's forehead and Patent Owner contends that this sensor would not be used on the back of the wrist due to signal strength and power concerns. *Id.* According to Patent Owner, "the resulting wrist-worn device would have low signal strength, would experience power management issues and

accordingly would be unsuitable for the wireless device discussed in Mendelson 2006." *Id.* at 49 (citing Ex. 2004 ¶ 100).

Third, and lastly, Patent Owner contends that "Mendelson 2006 further undermines a POSITA's motivation to add a protrusion based on Ohsaki," because "Ohsaki's board only prevents slipping due to movement if the sensor is positioned on the ***backside of the wrist***," and "the sensor should be placed on the ***forehead***, as Mendelson 2006 teaches." *Id.*

Analysis

We are persuaded that Petitioner's stated reasoning for the proposed modification is sufficiently supported, including by the testimony of Dr. Kenny. *See, e.g.*, Ex. 1003 ¶¶ 261–307. Petitioner relies on Mendelson-2006 for teachings regarding wireless communications with a handheld device and a touch screen display. Pet. 79–96. Patent Owner's arguments do not pertain to the modifications proposed and, as such, are misplaced. *See* Pet. Reply 28 ("Mendelson-Ohsaki sensor is modified based on the teachings of Mendelson-2006 to (1) include a 'touch-screen display,' and (2) 'wirelessly transmit information . . . acquired or processed by sensor 10 and pulse oximeter 20 to a PDA'") (quoting Pet. 81–90); Ex. 1047 ¶ 72. The number of detectors in the sensor of Mendelson-2006 and where it is positioned on the user's body are not persuasive to whether a person of ordinary skill in the art would have been motivated to "implement display 26" of Mendelson-799 "as a touch-screen display," and to enable wireless transmission to a PDA. *See* Ex. 1047 ¶¶ 72–73.

Petitioner has persuasively established "why, in view of Mendelson-2006's disclosure, a POSITA would have found it obvious (1) 'to implement display 26 as a touch-screen display' (*see* Petition, 84–86), and (2) 'to

enable Mendelson-Ohsaki's sensor 10 and pulse oximeter 20 to communicate wirelessly with a PDA' (*see* Petition, 86–91)." Pet. Reply 29. We find Petitioner's reasons for the proposed combination persuasive, including the motivations to perform the modifications described in the Petition. *See* Pet. 84–86 (discussion of touch-screen display), 86–91 (discussion of wireless communication).

H. Obviousness over the Combined Teachings of Mendelson-799, Ohsaki, Mendelson-2006, and Griffin

Petitioner contends that claims 8 and 26–28 of the '553 patent would have been obvious over the combined teachings of Mendelson-799, Ohsaki, Mendelson-2006, and Griffin. Pet. 97–100. Petitioner challenges claims 8 and 26–28, which include the magnetic connection limitation (discussed above) or the touch-screen display or mobile phone limitation (separately discussed above). We are persuaded by Dr. Kenny's testimony as to each limitation of these claims and the basis for combining the references as proposed. Ex. 1003 ¶¶ 310–323.

Patent Owner contends that this ground "fails for the same reasons as" as the prior two grounds discussed above. PO Resp. 50 ("a POSITA would not have been motivated to add Griffin to Mendelson '799 and Ohsaki because there are no external connections in the resulting combination" and "a POSITA reviewing Mendelson 2006 would not have been motivated to arrive at the claimed combination"). Thus, Patent Owner does not present any arguments for these claims other than those we have already considered above.

Based on our review of the parties' arguments and the cited evidence of record, we determine that Petitioner has met its burden of showing by a preponderance of evidence that claims 8 and 26–28 are unpatentable.

III. CONCLUSION

In summary:[10]

Claim(s) Challenged	35 U.S.C. §	References/Basis	Claims Shown Unpatentable	Claims Not Shown Unpatentable
1–3, 5, 6, 9–18, 20–24, 29	103	Mendelson-799, Ohsaki	1–3, 5, 6, 9–18, 20–24, 29	
4, 18, 24	103	Mendelson-799, Ohsaki, Schulz	4, 18, 24	
25	103	Mendelson-799, Ohsaki, Griffin	25	
7, 19	103	Mendelson-799, Ohsaki, Mendelson-2006	7, 19	
8, 26–28	103	Mendelson-799, Ohsaki, Mendelson-2006, Griffin	8, 26–28	
Overall Outcome			1–29	

[10] Should Patent Owner wish to pursue amendment of the challenged claims in a reissue or reexamination proceeding subsequent to the issuance of this decision, we draw Patent Owner's attention to the April 2019 *Notice Regarding Options for Amendments by Patent Owner Through Reissue or Reexamination During a Pending AIA Trial Proceeding*. *See* 84 Fed. Reg. 16654 (Apr. 22, 2019). If Patent Owner chooses to file a reissue application or a request for reexamination of the challenged patent, we remind Patent Owner of its continuing obligation to notify the Board of any such related matters in updated mandatory notices. *See* 37 C.F.R. § 42.8(a)(3), (b)(2).

IV. ORDER

Upon consideration of the record before us, it is:

ORDERED that claims 1–29 of the '553 patent have been shown to be unpatentable;

FURTHER ORDERED that, because this is a final written decision, parties to the proceeding seeking judicial review of the decision must comply with the notice and service requirements of 37 C.F.R. § 90.2.

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CERTIFICATE OF SERVICE

I hereby certify that the original of this Notice of Appeal was filed via U.S.P.S. Priority Mail Express on April 12, 2022 with the Director of the United States Patent and Trademark Office at the address below:

Office of the Solicitor
United States Patent and Trademark Office
Mail Stop 8, Post Office Box 1450
Alexandria, VA 22313-1450

A copy of this Notice of Appeal is being filed and served on April 12, 2022 as follows:

To the USPTO Patent Trial and Appeal Board:
Patent Trial and Appeal Board
Madison Building East
600 Dulany Street
Alexandria, VA 22313

(*via PTAB E2E – as authorized by the Board*)

To the U.S. Court of Appeals for the Federal Circuit:
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(*via email pursuant to 37 C.F.R. § 42.6(e)*)

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